WATER WORKS & SEWERAGE

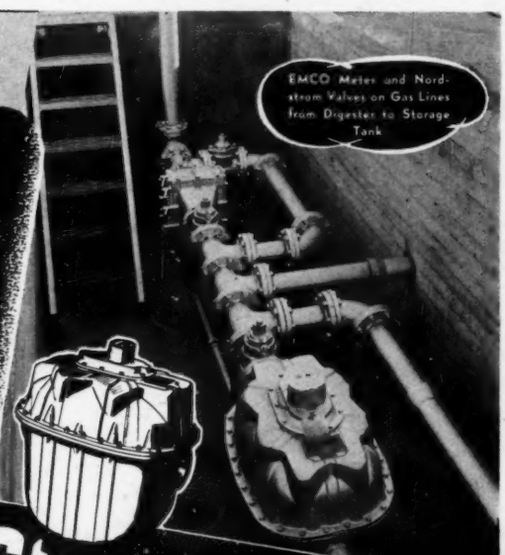
A GILLETTE ABP ABC PUBLICATION

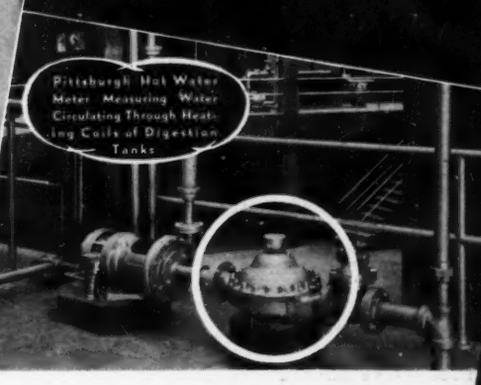
L. H. Enslow EDITOR

APRIL, 1937
VOLUME 84. No. 4

NORDSTROM PLUG VALVES

EMCO SEWAGE GAS METERS





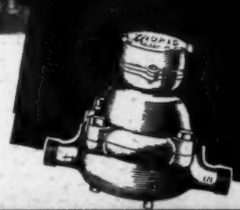
In Sewage Plants

Nordstrom Lubricated Plug Valves are being written into construction specifications by leading sanitation engineers whose experience with these valves has proven them to be always easy to turn, trouble free and leak resistant. Their quick, quarter-turn operation and ability to stand up under the most difficult conditions of corrosion and erosion make them especially adapted to the requirements of sewage treatment work and vastly superior to other types of valves which, due to their inherent construction, cause trouble and expense after a short time.

Ordinary meters won't operate economically and satisfactorily in sewage disposal plants. The character of the substances handled is such that corrosion and erosion will soon attack the operating parts unless they are of special materials and design. All EMCO meters are specially constructed from materials which in laboratory tests and on numerous installations have proven resistant to this destructive action.

WRITE FOR CATALOG 1031

PITTSBURGH WATER METERS



PITTSBURGH EQUITABLE METER CO.
MERCO NORDSTROM VALVE CO.

MAIN OFFICES PITTSBURGH, PA.

ATLANTA BUFFALO CHICAGO MEMPHIS
NEW YORK COLUMBIA KANSAS CITY PHILADELPHIA TULSA HOUSTON LOS ANGELES OAKLAND

Copyright U. S. Pipe & Foundry Co. 1937

FOUR YEARS AGO, the first pipe made from gray iron centrifugally cast in a metal mold *without chill*, was shipped from our Burlington plant. A year later we publicly announced Super-de Lavaud Pipe, the result of this pioneering process, which we developed and patented. Today, *more than 25 million feet* have been shipped from three of the U. S. plants. Tough, ductile and stubbornly resistant to impact, Super-de Lavaud *Chill-Free* Cast Iron Pipe is available with bell-and-spigot and mechanical joints, or with threaded ends (steel o.d. sizes).

U.S. cast iron PIPE

Cast iron and alloy cast iron pipe centrifugally or pit cast—for water works, gas, sewerage and drainage service as well as industrial uses involving corrosives.

U. S. PIPE & FOUNDRY CO.

BURLINGTON, NEW JERSEY

Foundries and Sales Offices throughout the U. S.

PUMP BUILDERS SINCE 1864

Non-Clogging

VICTOR Kimball-Krogh Pumps

Engineering Excellence

VICTOR-KIMBALL-KROGH "Non-Clogging" Sewage Pumps, either vertical or horizontal, embody the ideal features demanded by the modern sewage engineer. Impellers are of "two vane," semi-open type, WITHOUT wearing rings. They are exceedingly sturdily constructed and, even though high pumping efficiencies are not ordinarily of primary importance, offer also this added advantage. Over 70 years of pump building indicates the reliability and vast experience of the VICTOR-KIMBALL-KROGH organization.

VICTOR EQUIPMENT COMPANY

KIMBALL-KROGH PUMP DIVISION

515 Harrison Street
SAN FRANCISCO

1010 East 62nd Street
LOS ANGELES

Bulletin No. 601 offers full description and blue-prints—Yours, free for the asking.

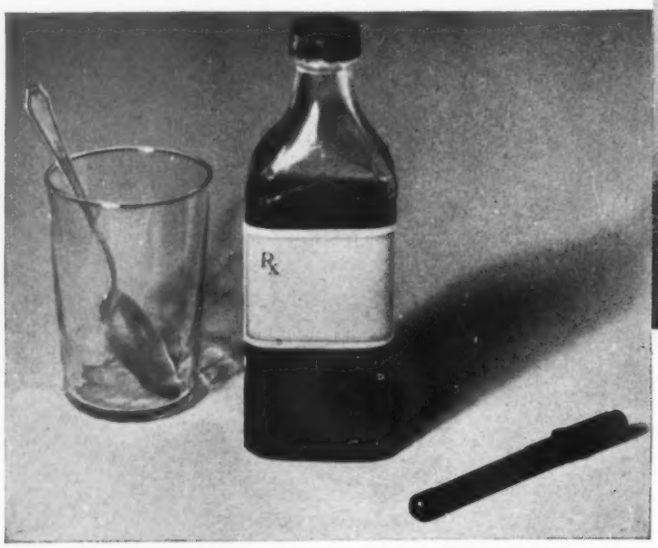
WATER WORKS AND SEWERAGE, April, 1937, Volume 84, number 4. Published monthly at 400 west Madison Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, $2.00 per year; Canadian and Foreign, $3.00 per year. Copyright, 1937. Entered as Second Class Matter, June 2, 1931 at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

"SPRING - *tra la la*"

"BASEBALL" . . . . . .
"THE OLD SWIMMING HOLE"
"PEN KNIFE" . . . . . .
"HIKES" . . . . . .
"SULPHUR and MOLASSES" etc.

All typical of Spring—the time of the year when Poets tell us a young man's fancy turns to love, etc.

But Spring also brings to the Plant Operator its full share of seasonable troubles.



April Showers not only bring forth May Flowers but also increased water flow—Spring floods—and a general breaking up of ice, all of these resulting in increased taste and odor problems.

Seasonal road repair work, particularly involving the use of tar products, usually result in phenolic tastes being contributed to the water supply.

(1) May we, therefore, suggest that all plants be fully prepared for increased sterilization required through the application of sufficient chlorine.

(2) That sufficient NUCHAR (Activated Carbon) be fed to adsorb these tastes and odors and therefore result in the furnishing of a palatable water.

The cost is so little that you will enhance your consumer relationship through so doing.

"Make your plans now to attend the 57th Annual Convention of the American Water Works Association, to be held June 7-11, 1937, at the Hotel Statler, Buffalo, New York."

230 PARK AVENUE
NEW YORK, N. Y.

418 SCHOFIELD BLDG.
CLEVELAND, OHIO

205 WEST WACKER DRIVE
CHICAGO, ILLINOIS

INDUSTRIAL CHEMICAL SALES DIVISION
WEST VIRGINIA PULP AND PAPER COMPANY

ELEVATED TANKS

by P·DM

THAT'S LIKE "STERLING" on SILVER

Yes, truly sterling meaning "of high merit" and embodying the *know-how* of master engineering . . . perfect craftsmanship . . . accumulated through 41 years of tank-building. Every unit is 100% guaranteed for flawless durability and carefree performance. These factors combined with P·DM designing service and field service insure perfect satisfaction and furnish your best reason for coming *first* to P·DM when tanks are needed.

PITTSBURGH · DES MOINES STEEL CO.

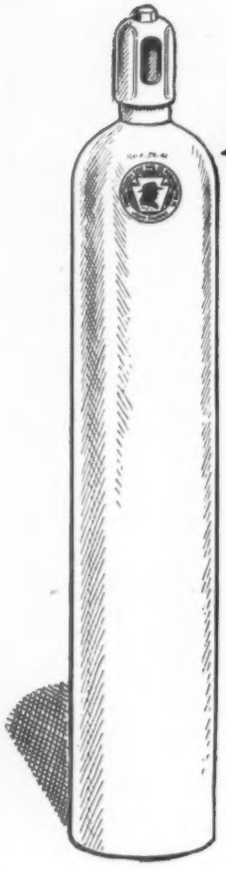
PITTSBURGH, PA. 3418 NEVILLE ISLAND—DES MOINES, IA. 919 TUTTLE ST.

NEW YORK, ROOM 918-99, 270 BROADWAY CHICAGO, 1222 FIRST NATIONAL BANK BUILDING

DALLAS 1223 PRAETORIAN BUILDING SAN FRANCISCO 625 RIALTO BUILDING

This is your assurance of purity in

Liquid Chlorine



Pennsylvania Salt Manufacturing Company has long been associated so closely with water works engineers and with their problems that we are keenly aware of the importance of *purity* in the liquid chlorine you use. For this reason, special care is taken to provide a product of the highest purity.

In this way, and by means of our highly specialized technical service, we seek to make our products and services of the utmost value to you. That policy has been widely appreciated, and the products of this Company are well and favorably known to engineers and municipalities alike throughout the country.

A further advantage is the convenient location of our plants, which assures you of quick deliveries to any point.

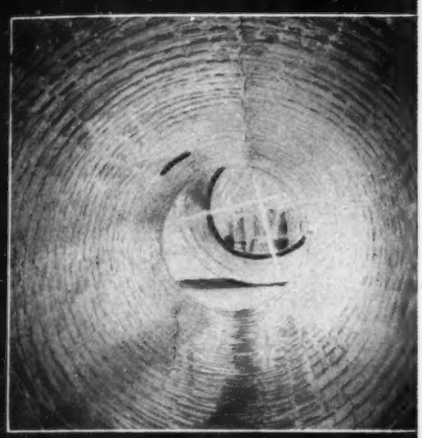
PERCHLORON · CHLORINE · AMMONIA · FERRIC CHLORIDE · ALUMINUM SULPHATE

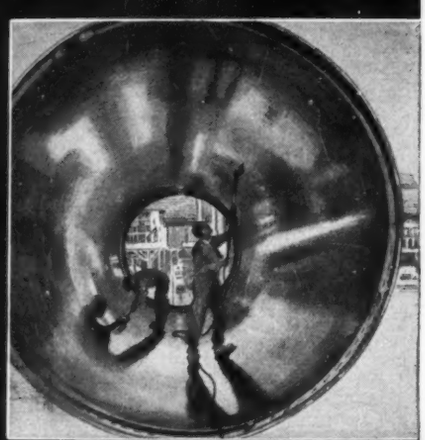
EST. 1850

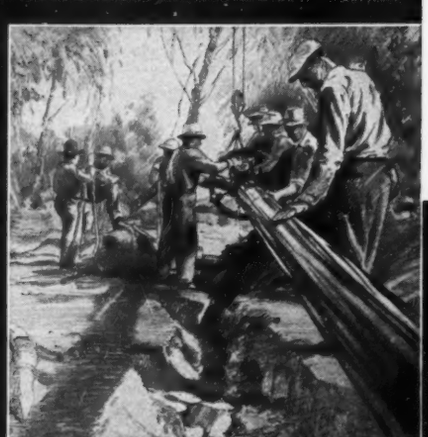
PENNSYLVANIA SALT MANUFACTURING COMPANY

EXECUTIVE OFFICES, WIDENER BLDG., PHILADELPHIA, PA.

BRANCH SALES OFFICES: NEW YORK · CHICAGO · ST. LOUIS · PITTSBURGH · TACOMA · WYANDOTTE







Reilly
PIPE ENAMEL & PRIMER
for Every Application

The high protective value of Reilly Pipe Enamel plus its adaptability to any of the standard methods of application, qualifies this product for many classes of work. • Tank and conduit linings or pipe line coatings are easily and economically accomplished by hand application, centrifugal spinning or coating machine. • Reilly Enamel backed by Reilly Primer provides the utmost in protection over an extremely wide temperature range . . no sag at 200°F, no cracking or peeling at minus 20°F. • Your inquiries as to further details—always welcome.

REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS · 500 FIFTH AVENUE, NEW YORK, N. Y.
ST. LOUIS PARK, MINNEAPOLIS, MINN.

FIFTEEN PLANTS TO SERVE YOU

Using the ROYER DISINTEGRATOR

• • • FROM THESE

They GET THIS!

WHERE THE ROYER DISINTEGRATOR IS BEING USED

Birmingham, Ala.
Reading, Pa.
Durham, N. C.
Freeport, N. Y.
Garden City, N. Y.
San Francisco, Calif.

and many other important sewage plants.

The Royer reduces in one operation large damp sludge cakes to a fine soil conditioner and salable product, for use on lawns and gardens.

Machines made in four sizes—either belt, gasoline engine or electric drive.

A Royer Pays for Itself

ROYER FOUNDRY & MACHINE CO.

158 Pringle St. — Kingston, Pa.

C. G. WIGLEY, Sole Rep.
3108 Atlantic Ave., Atlantic City, N. J.

3 for Buffalo!

WHEN a town gets one 2,000,000 gal. elevated water tank, that's news. When it gets three such tanks, there must be a STORY back of it. And that is what you will find at Buffalo, N. Y. The story can be told in a few simple words: *In large capacity elevated storage, the City of Buffalo found advantages and economies—possible with no other method of modernising its water supply system.*

The tank at the upper left was the first to be erected. It is located in the eastern section of the city. The tank at the upper right came next and is located in the southern part of town. The third tank serves the north portion of Buffalo. All are of the Horton radial-cone bottom design and all are alike except that the heights of the structures have been varied so that the tanks will all ride on the system and operate in the same hydraulic plane.

For complete story of the advantages possible with elevated storage, address our nearest office.

CHICAGO BRIDGE & IRON COMPANY

Chicago . . . 2198 Old Colony Bldg.
New York . 3390-165 Broadway Bldg.
Cleveland . . . 2262 Rockefeller Bldg.
Dallas . 1479 Liberty Bank Bldg.
Birmingham . 1586 North 50th St.
Tulsa . . . . . 1646 Hunt Bldg.
Houston . . . . . 2919 Main St.
Detroit . . . . . 1531 Lafayette Bldg.
Philadelphia . 1644-1700 Walnut St.
Boston . 1543 Consolidated Gas Bldg.
San Francisco . . . . 1083 Rialto Bldg.
Los Angeles . . . 1455 Wm. Fox Bldg.

Fabricating plants in CHICAGO, BIRMINGHAM, and GREENVILLE, PA.

CONTROLLED STRUCTURE . . .

This Exclusive Norton Development Means Better Porous Mediums for You . . . More Efficient Sewage Aeration

CONTROLLED Structure is an exclusive patented Norton achievement and assures the user a porous product with just the physical characteristics necessary to meet the individual requirements of his plant.

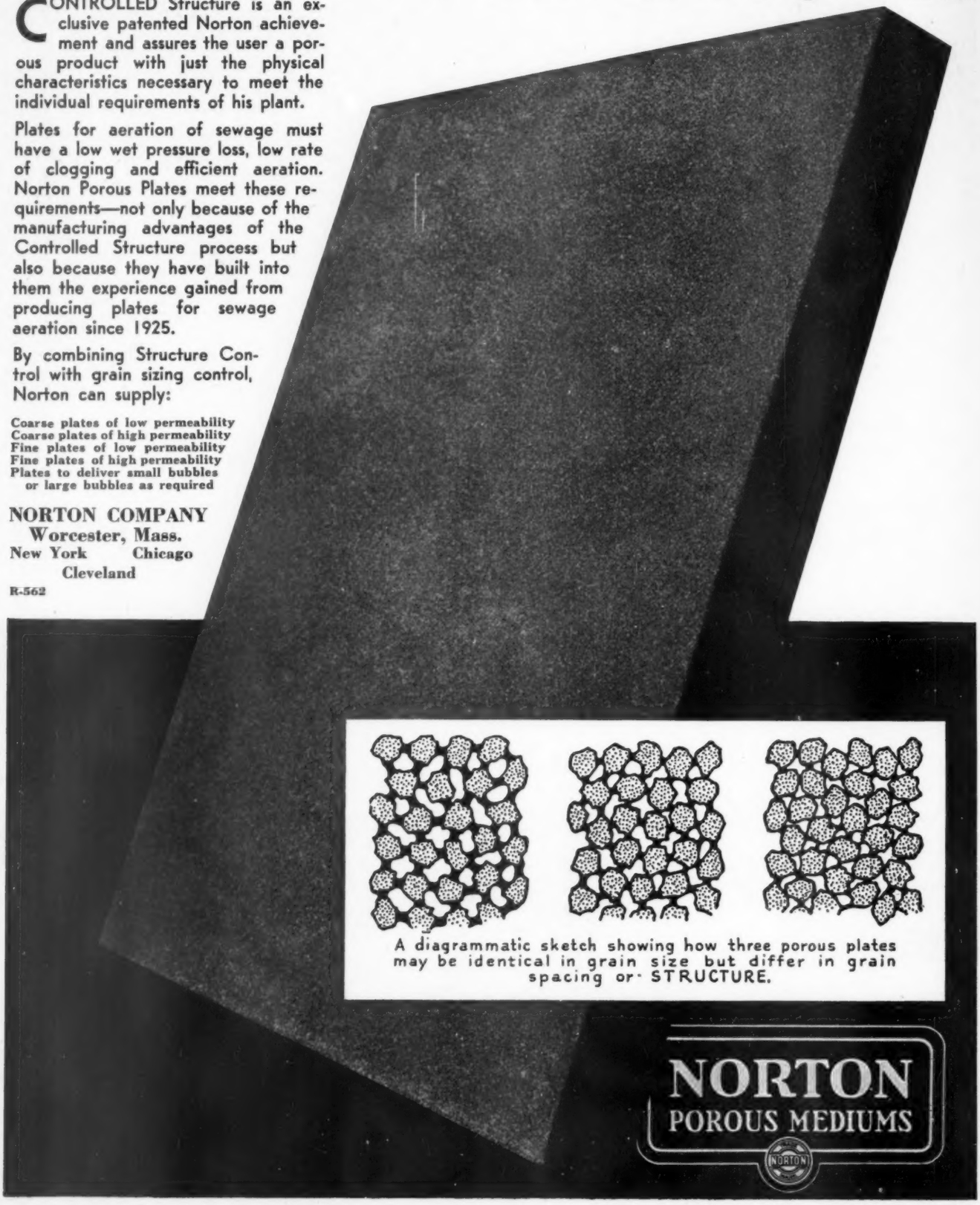
Plates for aeration of sewage must have a low wet pressure loss, low rate of clogging and efficient aeration. Norton Porous Plates meet these requirements—not only because of the manufacturing advantages of the Controlled Structure process but also because they have built into them the experience gained from producing plates for sewage aeration since 1925.

By combining Structure Control with grain sizing control, Norton can supply:

Coarse plates of low permeability
Coarse plates of high permeability
Fine plates of low permeability
Fine plates of high permeability
Plates to deliver small bubbles or large bubbles as required

NORTON COMPANY
Worcester, Mass.
New York Chicago
Cleveland

R-562



A diagrammatic sketch showing how three porous plates may be identical in grain size but differ in grain spacing or STRUCTURE.

NORTON
POROUS MEDIUMS

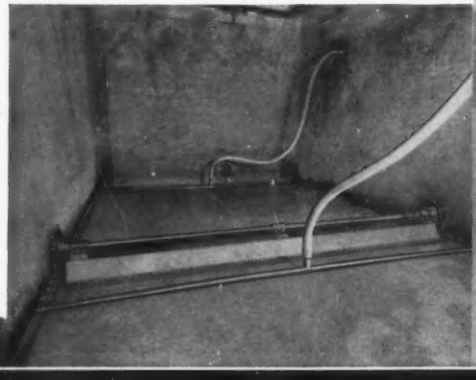
EBG COMES CLEAN . . . TANK CARS ARE CAREFULLY INSPECTED . . . *To detect any imperfection or the presence of foreign matter, all EBG containers are carefully inspected. The interiors are then washed . . . steamed . . . air dried — and reinspected. They must be immaculately clean before given an O. K. at EBG. Every precaution is taken to insure tank cars, drums and cylinders as clean and speckless as EBG Liquid Chlorine itself. That's why EBG is pure and uniform . . . and why it always "comes clean".*

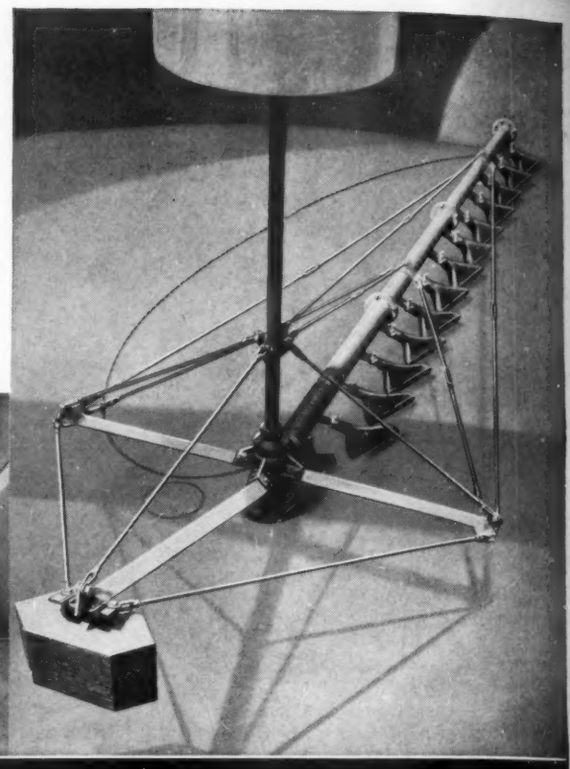
•

ELECTRO BLEACHING GAS COMPANY
Main Office: 60 East 42nd Street, New York, N. Y.
Plant: Niagara Falls, N. Y.

EBG Liquid Chlorine
FIRST IN THE COUNTRY

HOW TO HANDLE IT IF *IT* IS REMOVING FLOCCULENT SOLIDS





A Clearer Effluent—A More Concentrated Sludge —With the Rex Tow-Bro Sludge Remover • • •

● The Rex Tow-Bro was the first sludge remover to be designed and built especially for the removal of activated sludge and other types of flocculent solids. Its simple, though extremely effective design makes it the greatest development of the past decade in water or sewage treatment equipment.

With the Rex Tow-Bro there is less return sludge to be pumped—more capacity through the aeration and final settling tanks—because the sludge is obtained in a much more concentrated form. The effluent is clearer because the sludge is removed from the entire tank bottom with less disturbance—giving a better settling condition.

The sludge is less inclined to become septic because it is in the settling tank in an unaerated condition for a shorter length of time. And it may be drawn off at a faster rate without the vortex action that tends to dilute the sludge.

The Rex Tow-Bro sludge remover has been applied successfully in a great number of installations—in all sizes of tanks, either round or rectangular. It has proved itself to be unequaled at the job of handling flocculent solids or any solids sensitive to disturbance during concentration and removal.

This new catalog, "Rex Tow-Bro Sludge Remover," will help you solve your sludge removal problems. It contains complete and specialized information on the design and application of the Rex Tow-Bro sludge remover, fully explaining the theory behind its operation. See the Rex representative or write for your copy today!

CHAIN BELT COMPANY, 1610 W. Bruce St., Milwaukee, Wis.

REX

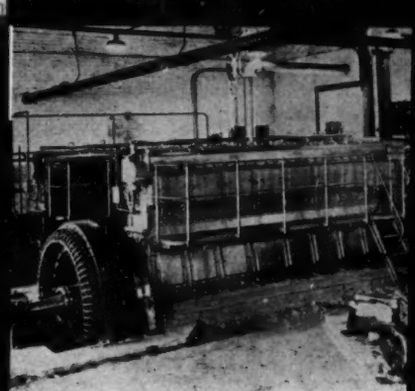
CHAIN BELT COMPANY of MILWAUKEE

Sanitation Equipment

KOPPERS

Featuring
BARTLETT HAYWARD DIVISION
BALTIMORE, MD.

- ✓ DESIGNERS
- ✓ BUILDERS
- ✓ PRODUCERS
- ✓ MANUFACTURERS
- ✓ DISTRIBUTORS
- ✓ OPERATORS



KOPPERS COMPANY, Pittsburgh, Pa.
Please send me information on:

☐ Coal	☐ Insecticides	☐ Tanks
☐ Coal Tar Roofing	☐ Municipal Incinerators	☐ Tarmac Road Tars
☐ Creosote	☐ Pipe	☐ Tarmac Handbook
☐ Dampproofing	☐ Piston Rings	☐ Treated Timber
☐ Disinfectants	☐ Sewage Disposal Equipment	☐ Waterproofing
☐ Fast's Couplings	☐ Signal Buoys	☐ Waterworks Gate Valves
☐ Fire Hydrants	☐ Sluice Gates	☐ Weed Killers
☐ Gas Holders		

Name.....

Address.....

.....

Million dollar subaqueous sewers rely on the durability and permanence of CONCRETE PIPE

Two 24-ft. lengths of 72-in. reinforced concrete pipe weighing 44 tons being lowered into position off Coney Island, New York City. This project is being built by City of New York with WPA funds. Thomas W. Hammond, Commissioner of the Department of Sanitation; Walter D. Binger, Deputy Commissioner, in charge of engineering; plant design and construction by Richard H. Gould, Chief Engineer and William L. Sylvester, Designing Engineer; Alfred R. Glock, Resident Engineer.

ABATEMENT of New York harbor pollution and health protection for the millions of bathers at Coney Island beaches required the building of a new sewage treatment plant at Coney Island. And part of that job was constructing a sewer with a 6,375-ft. subaqueous section of 72-in. concrete pipe.

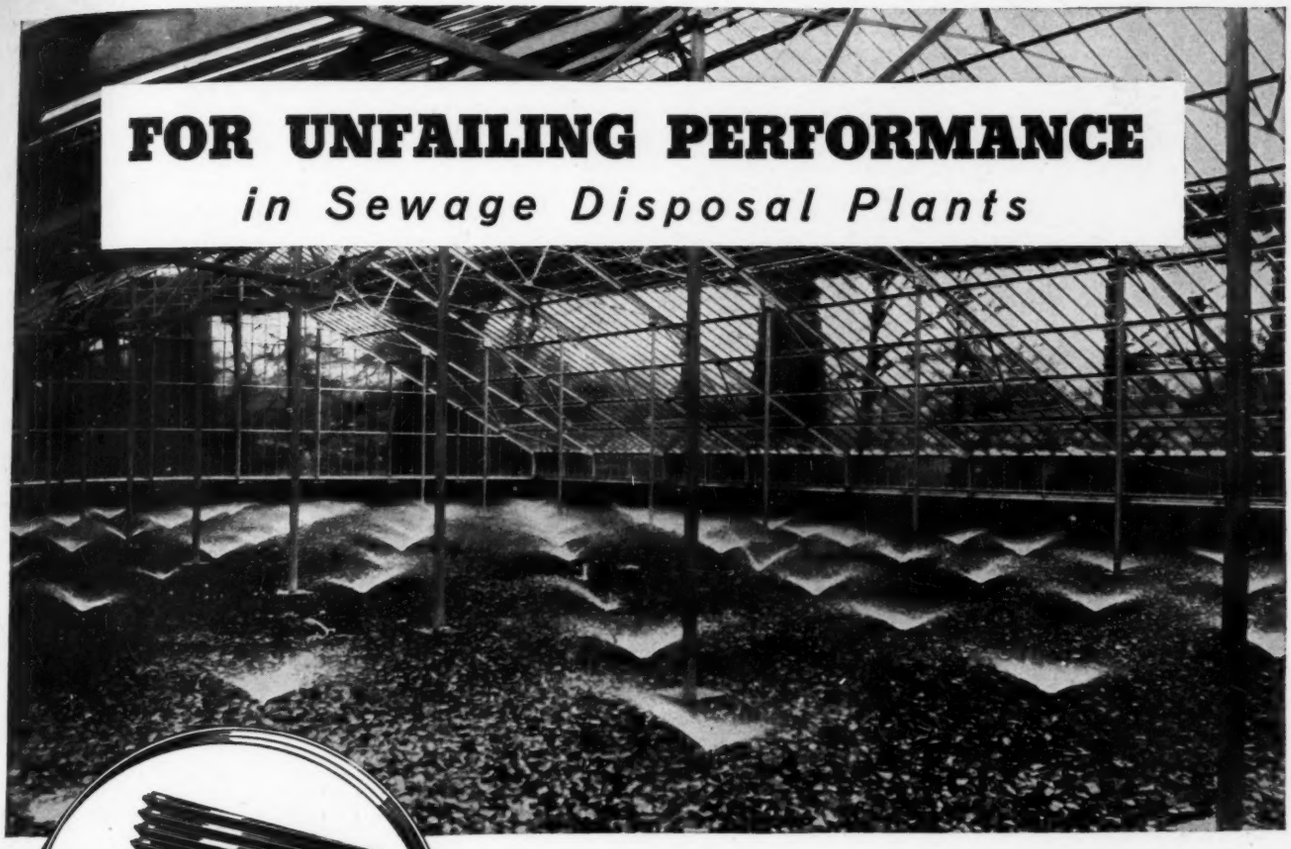
Double 24-ft. sections with watertight joints were lifted and laid with a steel truss "strong back" and the successive sections bolted together by a diver, three 48-ft. sections being laid each working day. With a shell thickness of 7 in. and a weight of 22 tons, these 72-in. pipe sections are believed to be the longest lengths ever cast for pipe of this diameter.

Well-engineered and well-constructed, this job is typical of the many sewers and sewerage systems throughout the country for which concrete is being used. Strong, permanent and moderate in cost, concrete pipe is the answer to a wide range of problems; whether the sewer is 12 inches or 12 feet in diameter.

The cheapest insurance of the success of a sewer job is to place the work in the hands of a competent sanitary engineer.

PORTLAND CEMENT ASSOCIATION, Dept. 4-29, 33 W. GRAND AVE., CHICAGO, ILL.

A National Organization to Improve and Extend the Uses of Concrete



FOR UNFAILING PERFORMANCE

in Sewage Disposal Plants

Notetheclean, sharp threads made on the job with standard tools.

ARCO CAST IRON PIPE

SUPER RESISTANT...EASY TO INSTALL

It cuts, threads and welds CLEAN on the job

COMBAT the elements that attack piping in sewage disposal plants! Use super resistant Arco Cast Iron Pipe. Because of its finer grain structure it will resist chemicals and oxidation — last longer — assure maximum economy.

Arco Cast Pipe is extra tough — extra corrosion resistant. Yet it is easily cut and threaded with standard tools right on the job! It welds smoothly, easily because it's free from common defects, banished by careful manufacturing.

It is perfect for heating coils in sludge digestion tanks, water lines in activated tanks and air lines and gas lines to collectors. Arco Cast Pipe is available in sizes 1½" to 12". Sizes up to 6" run 6', 12', and 18' lengths. Other lengths on special order. Either or both ends may be plain or threaded, tapped bell, grooved for special coupling or beveled for smooth welding. Standardize on Arco Cast Iron Pipe for permanent efficiency, maximum economy.

ARCO PIPE & FITTINGS DIVISION
AMERICAN RADIATOR COMPANY
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
40 West 40th Street, New York, N. Y.

MAIL THIS COUPON TODAY FOR THE ARCO CAST IRON PIPE MANUAL

Arco Pipe & Fittings Division
AMERICAN RADIATOR COMPANY
40 West 40th Street, New York, N. Y.

I am interested in Cast Iron Pipe. Send me your Arco Cast Iron Pipe Manual.

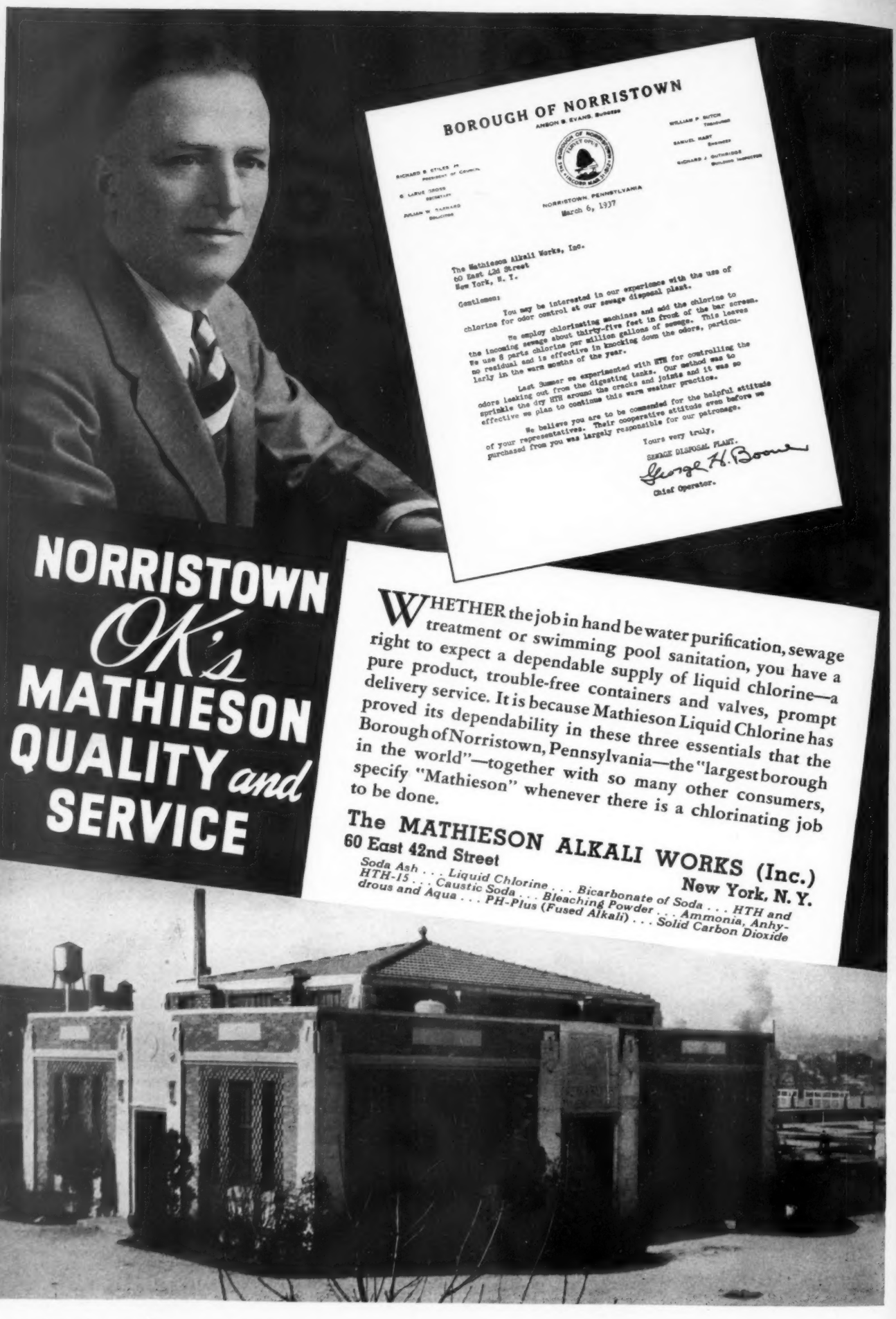
*Name*_____

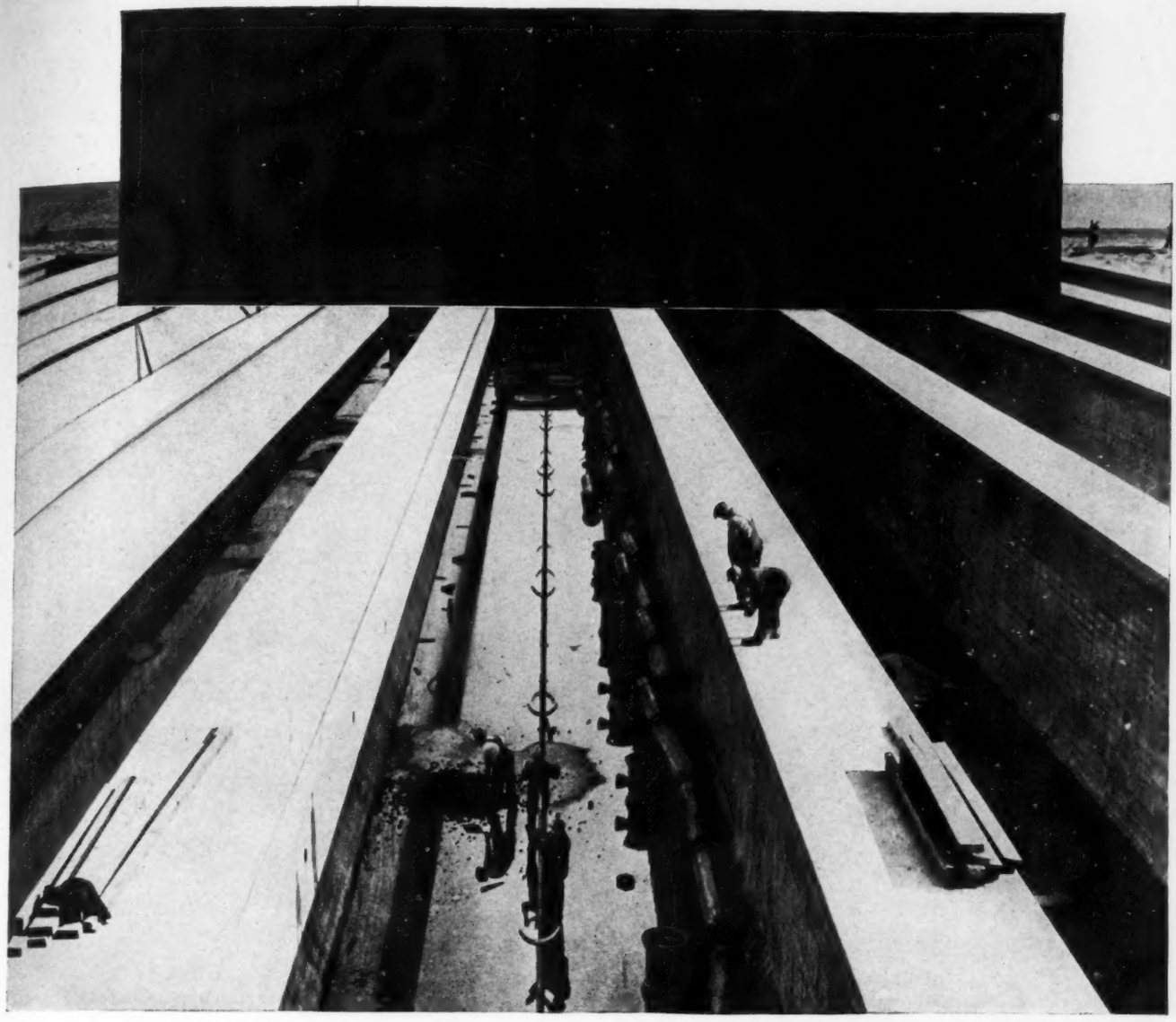
*Firm Name*_____

*Address*_____

*City*_____ *State*_____

ARCO CAST IRON PIPE


BOROUGH OF NORRISTOWN
ANSON B. EVANS, Burgess
NORRISTOWN, PENNSYLVANIA
March 6, 1937
The Mathieson Alkali Works, Inc.
60 East 42d Street
New York, N. Y.
Gentlemen:
You may be interested in our experience with the use of chlorine for odor control at our sewage disposal plant.
We employ chlorinating machines and add the chlorine to the incoming sewage about thirty-five feet in front of the bar screen. We use 8 parts chlorine per million gallons of sewage. This leaves no residual and is effective in knocking down the odors, particularly in the warm months of the year.
Last Summer we experimented with HTH for controlling the odors leaking out from the digesting tanks. Our method was to sprinkle the dry HTH around the cracks and joints and it was so effective we plan to continue this warm weather practice.
We believe you are to be commended for the helpful attitude of your representatives. Their cooperative attitude even before we purchased from you was largely responsible for our patronage.
Yours very truly,
SEWAGE DISPOSAL PLANT.
George H. Bowers
Chief Operator.
NORRISTOWN OK's MATHIESON QUALITY and SERVICE
WHETHER the job in hand be water purification, sewage treatment or swimming pool sanitation, you have a right to expect a dependable supply of liquid chlorine—a pure product, trouble-free containers and valves, prompt delivery service. It is because Mathieson Liquid Chlorine has proved its dependability in these three essentials that the Borough of Norristown, Pennsylvania—the "largest borough in the world"—together with so many other consumers, specify "Mathieson" whenever there is a chlorinating job to be done.
The MATHIESON ALKALI WORKS (Inc.)
60 East 42nd Street
New York, N. Y.
Soda Ash . . . Liquid Chlorine . . . Bicarbonate of Soda . . . HTH and HTH-15 . . . Caustic Soda . . . Bleaching Powder . . . Ammonia, Anhydrous and Aqua . . . PH-Plus (Fused Alkali) . . . Solid Carbon Dioxide



ASSURES BETTER CONCRETE with POZZOLITH

● The more difficult the job . . . the *greater* the need for POZZOLITH and the *better* concrete it assures!

That's agreed upon by many authorities, engineers, contractors. They have PROVED to themselves, *on water-works and sewerage jobs of every description,* that POZZOLITH accomplishes these much-desired objectives:

1. **Materially reduces volume of water.**
2. **Makes concrete easier-flowing, easier to place.**
3. **Reduces amount of labor to place concrete.**
4. **Checks "bleeding".**
5. **Builds denser, more-watertight concrete.**
6. **Induces highly-desirable pozzolanic activity.**
7. **Makes concrete more resistant to corrosive factors.**

The picture above shows a typical job where POZZOLITH has saved time and money, *while assuring better concrete!* Why not utilize the multiple advantages of POZZOLITH on *your* jobs? Investigate POZZOLITH *now!*

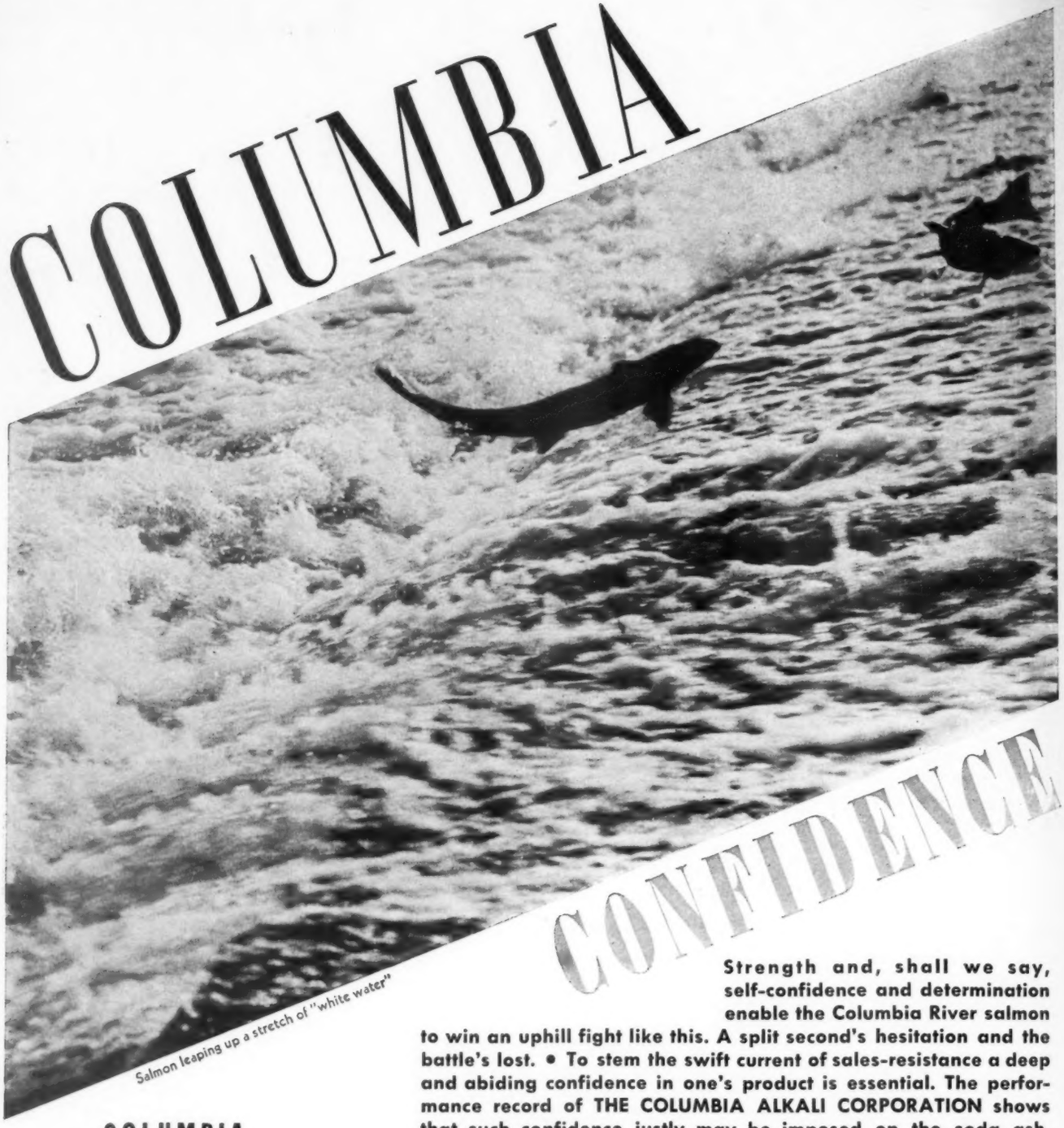
THE MASTER BUILDERS COMPANY • CLEVELAND, OHIO
In Canada: The Master Builders Co., Limited, Toronto, Ontario

Immense New Filtration Plant at Milwaukee, Wis., Offers Typical Proof!

Jos. P. Schwada, City Engineer, Milwaukee • Herbert H. Brown, Engineer in Charge, Milwaukee • Alvord, Burdick & Howson, Consulting Engineers, Chicago • Contractors: Kroening Engineering Corporation, and Stein Construction Company, Milwaukee.

(Actual photo of job shown above)

COLUMBIA



Salmon leaping up a stretch of "white water"

CONFIDENCE

Strength and, shall we say, self-confidence and determination enable the Columbia River salmon to win an uphill fight like this. A split second's hesitation and the battle's lost. • To stem the swift current of sales-resistance a deep and abiding confidence in one's product is essential. The performance record of THE COLUMBIA ALKALI CORPORATION shows that such confidence justly may be imposed on the soda ash, caustic soda, modified sodas, sodium bicarbonate, liquid chlorine and other products that come from its plants. Not for a split second has there been the slightest compromise with quality, . . . and there never will be. • You can count on COLUMBIA to pass on to the consumer all actual improvements in the products and their applications. And you can count on COLUMBIA, like the salmon of the same name, to be ever out in front.

Send for new folder on COLUMBIA Liquid Chlorine.

COLUMBIA
LIQUID CHLORINE
(In Single and Multiple Unit Tank Cars, 100 and 150 lb. Cylinders.)

Other COLUMBIA Products

SODA ASH
CAUSTIC SODA
SODIUM BICARBONATE
MODIFIED SODAS
CALCIUM CHLORIDE

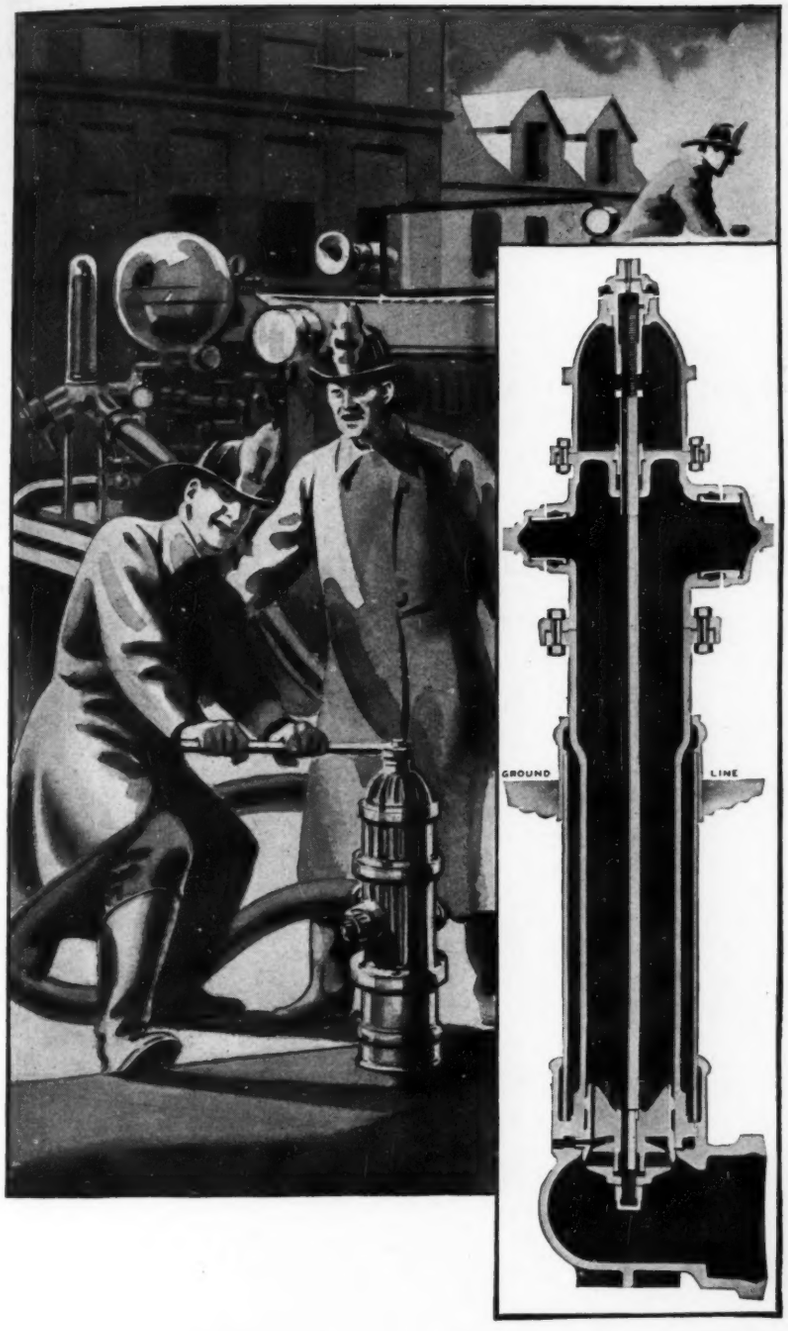
THE COLUMBIA ALKALI CORPORATION

BARBERTON • OHIO

NEW YORK • CHICAGO • CINCINNATI • PITTSBURGH

"Lean on it, Joe!

YOU CAN'T HURT A MATHEWS HYDRANT"



The chief's right. Nothing you can do with a wrench will hurt a Mathews Hydrant. It's built for such emergencies as 200-pound firemen who want more pressure than the town supplies.

In the first place, a Mathews Hydrant's stem doesn't revolve when the wrench is turned. It pushes straight down and can't be twisted out of shape.

Furthermore, the strain is all held at the top by a stop nut. The stem can't be buckled.

And last but not least, the operating nut is a wear-resistant malleable iron cap, a shield, which can be replaced if it is battered by a stilson.

Specify Mathews. They're built for emergencies.

• • •

Notice the brass stop-nut (shown in white) at the top of the stem just below its threads. When the hydrant is fully opened, this nut meets the top of the stuffing box nut and prevents the bottom of the stem from resting on the elbow. The strain of forcing an already open Mathews Hydrant cannot make the stem buckle.

R. D. WOOD CO.
400 Chestnut St., Philadelphia, Pa.

manufacturers of SAND-SPUN PIPE which is centrifugally cast in sand molds, and R. D. Wood heavy-duty gate valves for water works.

Mathews Hydrants
BUILT FOR EMERGENCIES

FORCEFUL FACTS ON SEWAGE AERATION BY AIR DIFFUSION—No. 12

For cities

which require complete sewage treatment

Activated Sludge by Air Diffusion is Usually the Proved Solution of the Problem

HERE are some of the reasons. They apply equally well to selection of treatment for most cities and towns requiring complete treatment:

1. *Lowest cost operation per pound of BOD removed.*
2. *Lowest cost construction per MGD capacity.*
3. *Relatively small plant area required.*
4. *Abolition of nuisances.*

Just as the activated sludge process leads the field in solving the problem of complete sewage treatment—so do Aloxite Brand Diffusers lead the field in providing the simplest and most effective means of introducing air into the sewage for oxidation. This is the heart of the process.

Combined with this product is an engineering service backed by years of experience in applying Aloxite Brand Diffusers to many successful installations. When you are developing a sewage treatment project, or when any question arises on diffusers and related subjects, make use of this service.

ALOXITE BRAND
REG. U.S. PAT. OFF.
DIFFUSER MEDIA
PLATES AND TUBES

THE CARBORUNDUM COMPANY • NIAGARA FALLS, N.Y.
REG. U.S. PAT. OFF.

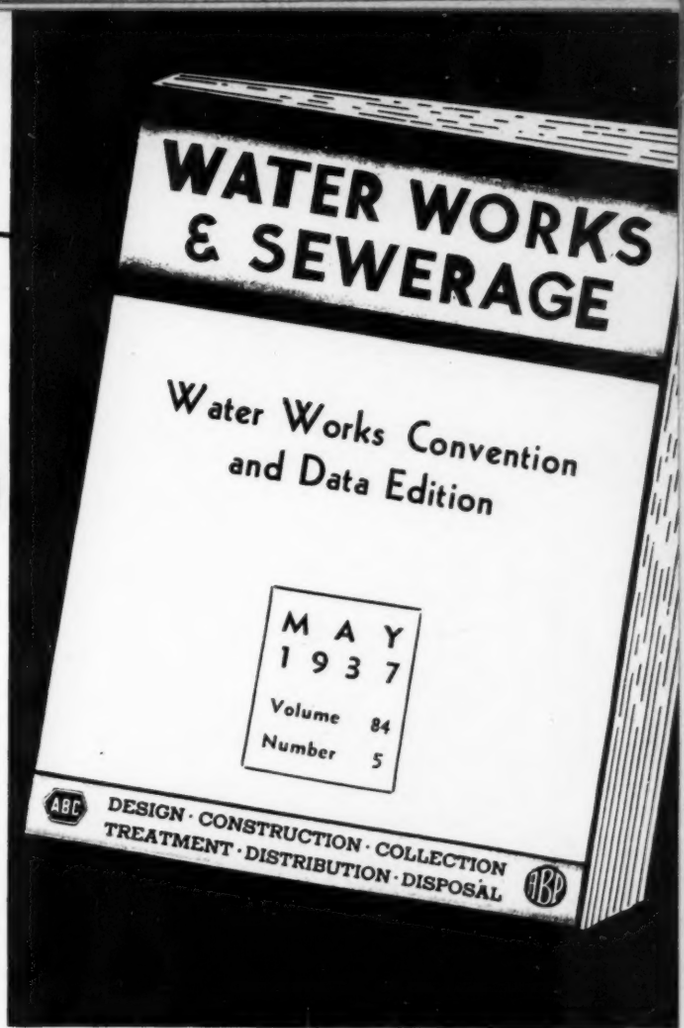
Sales Offices and Warehouses in New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Grand Rapids

(Carborundum and Aloxite are registered trade-marks of The Carborundum Company)

Announcing

THE MAY WATER WORKS CONVENTION & DATA EDITION *of*

WATER WORKS & SEWERAGE



A COMBINATION CONVENTION ISSUE PLUS REFERENCE AND DATA BOOK UNDER ONE COVER! This plan carried out very effectively in 1936 is to be repeated and improved upon for 1937. Throughout the data section, manufacturers' pages in catalog copy form will be appropriately placed according to subject. Reference information on design, construction, operation, treatment of water and sewage, and other up-to-the-minute subjects, will be prepared and completely indexed under direction of our Editor—Linn H. Enslow.

Circulation of this issue (over 7,000 copies) going to ALL subscribers and, in addition to many Water Works Superintendents, Sewage Officials, City Engineers, Consulting and Sanitary Engineers, etc., (prospective subscribers) assures a copy being placed in the hands of those most active in these fields.

The nature of its contents will make it a valuable reference source for constant future use.

Advertisers may refer to these catalog pages in their monthly advertising throughout the year.

CATALOG INFORMATION

Permanently bound in this Annual Edition of WATER WORKS AND SEWERAGE is insured against loss and is quickly available for reference.

MAKE YOUR PRODUCT EASY TO BUY

Manufacturers will do well to decide now on the space needed to properly catalog their products—then mail space reservations in order to get the best possible position.

WATER WORKS AND SEWERAGE

400 W. Madison St., Chicago **155 E. 44th St., New York City**

1937 REFERENCE AND DATA

Section of May Convention Number of

WATER WORKS AND SEWERAGE

A Daily Reference Guide for Information and Data on Design, Construction, Operation and Maintenance of Water Works and Sewerage; Collection, Purification and Distribution of Water; Treatment and Disposal of Sewage.

PARTIAL LIST OF SUBJECTS COVERED

KINKS FOR WATER WORKS OPERATORS
- Methods of Cleansing Service Pipe
- Ridding a Reservoir of Tadpoles
- Location of Water Services
- Mud Balls in Filter Beds
- Valve Operation and Maintenance
- Stopping Flow from Broken Corporation Cocks
- Tapping Mains
- Correcting Red Water Troubles
- Etc., Etc., Etc.

KINKS FOR SEWERAGE OPERATORS
- Sewer Maintenance, Cleaning, Use of Effluents, etc.

CONVERSION FACTORS FOR ENGINEERS

INFORMATION ON WATER AND SEWAGE WORKS PROBLEMS—WHERE IT CAN BE FOUND

PRACTICAL HYDRAULICS

SELECTING THE RIGHT METER

CHLORINE—ITS HANDLING AND APPLICATIONS IN WATER AND SEWAGE TREATMENT

ADVANCES AND DEVELOPMENTS IN WATER CHLORINATION

ADVANCES AND DEVELOPMENTS IN SEWAGE CHLORINATION

METERAGE—METHODS, RATES, RESULTS
- Setting Meters
- Results of Meterage
- Meter Rates

LEAKAGE AND WATER WASTE SURVEYS
- Causes of Waste
- How Pitometer Survey Is Made
- What Water Waste Surveys Disclose
- Locating Leaks—Aquaphone
- Locating Leaks—Radio Finder

WATER MAIN CLEANING—WHEN TO CLEAN, METHODS, RESULTS

REHABILITATION OF OLD WATER MAINS
- Methods Employed—Results

THE INSTALLATION AND SERVICING OF POROUS AIR DIFFUSER MEDIUMS

TREATING WATER TO PREVENT CORROSION
- Red Water and Tuberculation

AMMONIA IN WATER TREATMENT
- When and Where Most Effective with Chlorination

METHOD OF ELIMINATING DEAD ENDS
- To Relieve Stagnation—Red Water—Bad Tastes

MAINTENANCE OF SANITARY SEWERS
- Root Control, Cleaning, Etc.
- A Root Proof Joint
- Maintenance due to the Misuse of Sewers
- Maintenance of Sanitary Sewers
- Cleaning Tools

WATER WORKS ACCOUNTING
- Uniform Classification of Accounts
- Billing and Collecting Methods in a Small City
- Accounting System for Large City
- Use of Machines in Water Works Accounting

GLOSSARY OF TERMS
- Water and Sewage Practices

TABLES AND GRAPHS
- Loss of Head
- Friction
- Pipe Line Capacities
- Contents—Tanks, Pipe
- Conversion Factors
- Fire Flows
- Power Consumption

DEFINITIONS OF VALUES
- Pumps and Pumping
- Prime Movers

FIRE HYDRANTS
- Installation and Maintenance

METERS
- Maintenance, Test, Repair, Rates

PAINTS FOR WATER WORKS AND SEWERAGE PLANTS

GADGETS
- Home Made Instruments and Equipment for Water and Sewage Treatment Work

UTILIZATION OF SEWAGE SLUDGE GAS
- Heat, Power, Refrigeration

DEVELOPMENTS IN WATER AND SEWAGE TREATMENT
- What's New in Water and Sewage Treatment

NOTES ON IRON COAGULENTS
- Water and Sewage
- Ferric Chloride—Ferric Sulphate—Chlorinated Copperas

ROOT CONTROL IN SEWERS
- Unique Method of Cleaning Sewers

ACTIVATED SLUDGE PROCESS IN SEWAGE TREATMENT
- Improved Methods of Operation and Maintenance

SLUDGE DEWATERING AND DISPOSAL

FILTRATION PLANTS—OPERATION AND MAINTENANCE
- Kinks, Operating Hints, Gadgets

WATER SOFTENING—NEW DEVELOPMENTS
- Chemicals and Results of Softening

TASTE AND ODOR CONTROL
- Latest Developments in Carbon—Ammoniation, Etc.

Catalog Information Covering Equipment, Materials, Instruments, Chemicals and All Types of Devices to meet your requirements, permanently bound in the May Convention Issue of

WATER WORKS AND SEWERAGE

155 E. 44th Street
New York

Published by
Gillette Publishing Company

400 W. Madison Street
Chicago

WATER WORKS & SEWERAGE

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

ARTICLES AND AUTHORS Scheduled for Future Issues

"Annual Reference and Data Issues"—In our May issue will be repeated the voluminous Reference and Data Section which was presented for the first time in our 260 page Water Works Convention Issue of 1936. Failing to meet the demand for it, and in response to many requests for a reprinting of what has been dubbed "The Operator's Bible," our 1936 Reference and Data Edition is to be revised where needed and further strengthened with additional material. At this time, the publishers and our readers will both be benefitted by contributions and suggestions which will lead to improvements; or which will make it possible for us to add data tables or graphs considered by YOU as worthy of inclusion. We have had many letters of commendation and now seek constructive criticism from you, who have had opportunity to find those "weak spots" which have the habit of appearing in most "FIRST EDITIONS." This late announcement (and request) was intended for an earlier issue, but overlooked. With prompt action NOW there still remains time for making correction and additions. We urgently request suggestions and the pointing out of errors, as truly worth while contributions and, likewise, a compliment from those who have made use of the 1936 issue.

Faithfully yours—
Ye Ed!

"Recent Improvements to Buffalo's Water System"—by Alan D. Drake, Buffalo's Director of Water, constitutes a timely article for our next issue which will appear immediately prior to the Convention of the American Water Works Association which is being held in Buffalo, June 7-11th. Mr. Drake's article will recount a development, involving the world's largest elevated tank project and benefits derived therefrom.

"Water Filtration at Hammond, Indiana"—Is the caption of an article by Leo Besozzi, Supervising Engineer of Hammond's Water Department which describes and picturizes the attractive new Filter Plant of Hammond, and sets forth unique design results during the first several months of operation.

"MEETINGS SCHEDULED"—Please note that in future issues the list of "Meetings Scheduled" will appear in the fore part of our rear advertising section. For convenience, each issue will show the page number in the "Table of Contents."

Vol. 84, No. 4

CONTENTS for APRIL, 1937

Corrosion Control by Deaeration 109
By SHEPPARD T. POWELL and H. E. BACON
Consulting Chemical Engineer and Associate, Baltimore, Md.

The Algae Strainer 112
By HARRY U. FULLER
Chief Engineer, Portland Water District, Portland, Me.

Meeting New England Water Works Association 114

Practical Hydraulics 119
By P. S. WILSON
Assistant to Secretary, American Water Works Association

Operating Control Tests for the Activated Sludge Process 121
By T. R. HASELTINE
Sanitary Engineer, Kansas City, Mo.

22nd Annual Meeting New Jersey Sewage Works Association 124

The Rehabilitation of a Badly Damaged Sewer 130
By WM. D. DARBY
Consulting Engineer, West Allis, Wis.

Sludge Disposal by Incineration 132
By PHILIP B. STREANDER
Watson and Streander, New York, N. Y.

A. W. W. A. Anticipating Largest Convention 137

Practical Electricity in the Plant 138
By MARSDEN C. SMITH
Engineer of Water and Electricity, Richmond, Va.

Indiana Section Holds Record Meeting 140

Compressed Air Flushing of Small Mains 141
By R. F. BROWN
Plant Manager, California Water Service Co., Stockton, Calif.

Cleveland's Experimental Pilot Plant at Baldwin Filters 142
By W. C. LAWRENCE and MATHEW M. BRAIDECH

Editorial 146

Equipment News 64

Catalogs and Literature Received 68

Meetings Scheduled 70

Published monthly by the GILLETTE PUBLISHING CO., Daily News Building, Chicago, Ill.

Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under the Act of March 3, 1879. Published monthly at 400 W. Madison Street, Chicago, Ill. Per Copy, 25c. Subscription rates $2.00 per year. Canadian and Foreign, $3.00 per year. Copyright, 1937, by Gillette Publishing Company, Publishers of: Water Works and Sewerage, Roads and Streets, Sporting Goods Journal, Mida's Criterion, Oil and Soap, Powers' Road and Street Catalog and Data Book.

HALBERT P. GILLETTE, Pres. and Editor in Chief; E. S. GILLETTE, Vice-Pres. and Publisher; L. H. ENSLOW, 155 East 44th Street, New York, N. Y., Vice-Pres. and Editor; J. M. ANGELL, JR., Eastern Manager; T. F. KILROE, New England Representative; C. T. MURRAY, Managing Editor; JOHN R. BAYLIS, Associate Editor; D. G. LEDGERWOOD, Make-Up Editor.

Chicago Office, 400 W. Madison Street. Cleveland Office, 1601 Lauderdale Avenue, Lakewood, Ohio. New York Office, 155 East 44th Street. San Francisco Office, 155 Montgomery Street. Los Angeles Office, 318 W. Ninth Street.

Addresses will be changed as frequently as desired, upon notification; not otherwise. Changes of address should be sent in at least two weeks before the date of the next issue of *Water Works and Sewerage*, in order for them to be effective for that number. Immediate notice should be given of any delay in the receipt of the magazine.

THE use of cast iron pipe for sanitary sewer construction has been rapidly increasing for several years. Engineers are now insisting on infiltration-proof sewers with permanently tight joints. They want an impermeable material known to resist effectively corrosives such as acid trade waste. They know that a permanent structure *must* have high resistance to corrosion and crushing load. Cast iron pipe meets all these requirements. For further information, address The Cast Iron Pipe Research Ass'n., Thos. F. Wolfe, Research E'g'r, 1013 Peoples Gas Bldg., Chicago.

CAST IRON

Cast iron pipe installed in sanitary sewer, Long Branch, N. J.

CAST IRON PIPE

WATER WORKS AND SEWERAGE
A GILLETTE PUBLICATION
VOL. 84 APRIL, 1937 No. 4

CORROSION CONTROL BY DEAERATION

*An Experience with Low Cost Mechanical Deaeration on a Long Steel Supply Main**

By SHEPPARD T. POWELL[1] and H. E. BACON[2]
Baltimore, Maryland

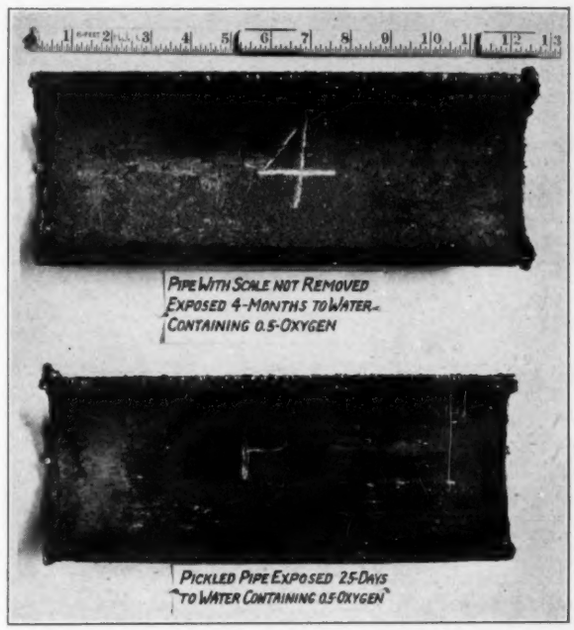
ALL BRANCHES of engineering in which the handling of water is involved have found the corrosion of ferrous materials to be a major problem. Preventive methods have been developed as more detailed knowledge of the corrosion process has been gained. At the present time the mechanism of corrosion under various conditions has been the subject of considerable experimental and theoretical study and is fairly well understood. It is well established that the attack of water upon iron results in a concentration of hydrogen ions at the surface of the metal which stops the corrosion process under the conditions usually encountered in ordinary water for domestic or industrial use. Dissolved oxygen in the water reacts with this protective hydrogen, which is thus removed, and in consequence permits the attack on the metal to continue. Speller lists the oxygen concentration as first in importance among the factors in corrosion by water in the neutral zone.

Protective Coatings

Many methods of corrosion control seek to prevent the water from coming in contact with the metal, by interposing protective layers of various kinds. These may be deposited chemically, as in the case of films which confer passivity on the metal, or scales formed from minerals in the water. Protective coatings and linings are also applied in the form of various paints and cements. Efforts to prevent the corrosion of water mains are generally effected in this way, and when carried out properly such treatment is successful.

Oxygen Removal

Since dissolved oxygen is generally necessary for the continuous attack of water upon ferrous materials, considerable attention has been given to removal of this gas from water. It is a well-established fact that corrosion of pipes carrying hot or cold water can be enormously curtailed merely by removal of dissolved oxygen from the water. Such treatment is regarded as imperative for boiler feedwater and is accomplished by elevating the temperature to reduce the solubility of oxygen, and venting the gas which is evolved. Chemical reducing agents are frequently used to complete the deaeration of the water. Hot water heaters have been used to a limited extent for partial deaeration of hot water used in large buildings, and cold water has been deactivated by apparatus which provided for removal of oxygen by contact with scrap iron. However, removal of dissolved oxygen has not been widely practiced except for the deaeration of boiler feedwater.

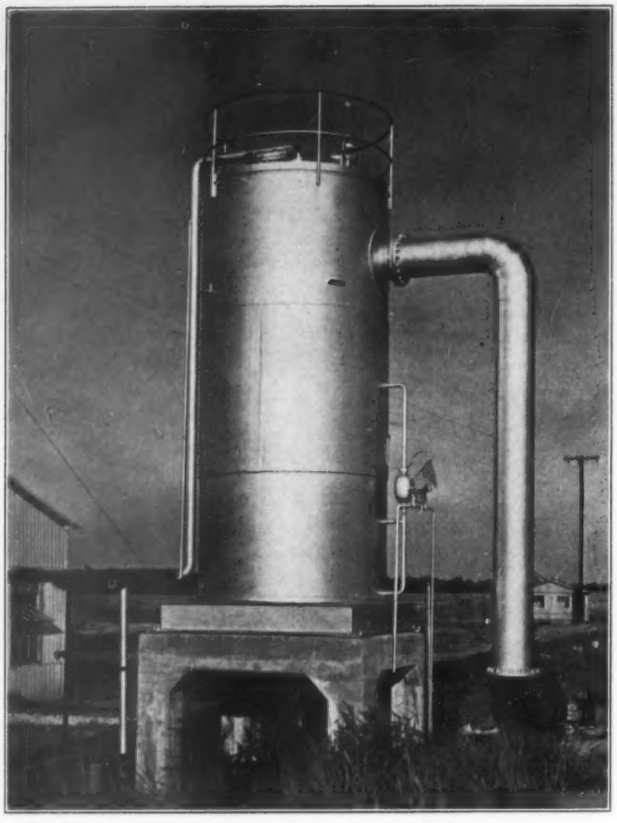


A Dual Demonstration in Corrosion Control. (Below) The Non-Corrosiveness of Deoxygenated Water on Bare Smooth Walled Steel Pipe. (Above) The Effect of Mill-Scale in Increasing Corrosion, Even in the Practical Absence of Dissolved Oxygen and pH Values Approaching 8.2

Freeport Sulphur Co.'s Problem

The Freeport Sulphur Company, operating mines in Louisiana and Texas, has encountered the problem of corrosion in connection with its water supply system, and the corrective methods adopted have attracted considerable interest. This company has developed the sulphur resources in the Mississippi delta below New Orleans, with a mine located at Grande Ecaille, Louisiana. Since the sulphur mining process requires large volumes of hot water and it is also necessary to generate considerable steam, an adequate water-supply is essential to this industry. This was obtained by establishing a

[1]Consulting Chemical Engineer and [2]Associate.
*Published by permission of Freeport Sulphur Company.—*The Authors.*



The Completed Deaerator. Capacity 4 M.G.D. Vacuum 28 to 28.5 Inches. (For Details and Dimensions, See Sketch.)

reservoir and pumping station at Port Sulphur located on the Mississippi River, nine miles from the mine. The reservoir water is pumped from here to the property through an uncoated steel pipe. This line is welded and is carried on piles and passes under water only at Bayou crossings.

Provision was made for supplying 4,090,000 gallons per day, which was required for operation at the desired rate. However, in four months the carrying capacity of the line decreased nearly 25 per cent due to corrosion of the pipes which, likewise, seriously threatened the destruction of the pipe. An examination of the pipe revealed excessive tuberculation which accounted for the marked rise in the coefficient of friction and consequent depreciated carrying capacity of the line, and increased pumping costs.

Corrective Treatments Tried and Considered

A number of treatments were tried in an effort to restore the capacity of the line and control the attack on the metal. Inhibited acid did not satisfactorily remove the rust tubercles, although this treatment resulted in a slight restoration of capacity immediately after the treatment was applied. Mechanical methods were most effective for cleaning, but afforded too temporary relief. Any treatment that restored a smooth surface had the disadvantage of exposing fresh metal, in spots, to corrosion.

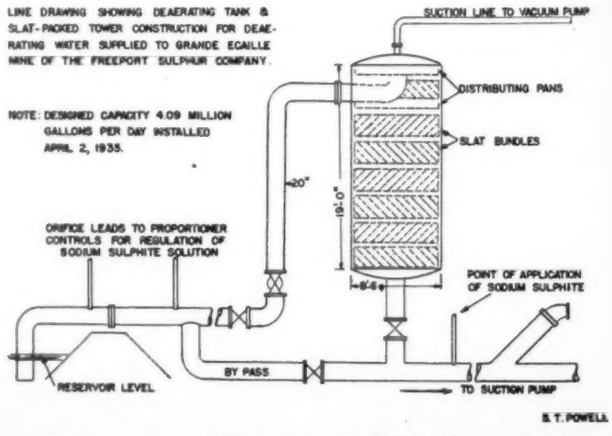
Consideration was given to lime treatment to inhibit agressivity of the water, involving the possibility of producing on the pipe walls a thin protective coating of calcium carbonate. The river water, however, was not susceptible to the precipitation of calcium carbonate by this treatment because the pH of the settled river water was approximately 8.0, no bicarbonate alkalinity being present most of the time. Sodium silicate was applied in the hope that a silicate scale could be deposited, but evidence indicated that corrosion continued, or was retarded so little that the treatment was not justified. Further, there was definite evidence that silicate scale was developing in the boilers and, fearful of consequences, the immediate termination of the silica treatment was determined on.

Oxygen Removal Turned to

These experiences led finally to consideration of deaeration of the supply as that treatment which would insure a most overall satisfactory solution of the problem. The oxygen present in the water varied between 6 and 10 parts per million, and exceeded the saturation value at times because of the presence of prolific growths of micro-organisms. Deaeration with sodium sulphite was undertaken experimentally, and almost immediately a reduction was noted in the rate at which the capacity of the line was decreasing. The expense of chemical deaeration would have been prohibitive, however; and, having served to demonstrate the efficiency of de-oxygenation, it was not considered as a permanent treatment. In view of the proven benefits of dissolved oxygen removal, steps were taken to design equipment for mechanically deaerating the water by passing it through an evacuated chamber.

The only previous large-scale application of the deaeration process had been at Coolgardie, Australia, where 6,000,000 gallons of water per day are deaerated to protect a 350-mile pipe line. Inquiries directed to the officials in charge of this latter installation brought the information that excellent results were being obtained, which confirmed statements appearing somewhat earlier in the technical literature. As a result of the investigation and the favorable record of the Australian plant, a cold water deaerator was designed. This consisted of a tower, into the top of which water was to be introduced in the form of a relatively fine spray, dropping into a collecting chamber at the bottom of the unit, from which it could be pumped into the pipe line. The apparatus was to be maintained under a specified vacuum and the gases, flashed from the water, removed by the vacuum pump. An adequate seal was designed so that the desired vacuum could be maintained. Calculations were made to determine the operating characteristics of various designs and the required vacuum pump capacities and cost factors involved in installation and operation.

On the basis of this information a small pilot plant, having a capacity of 100 gallons per minute, was built. This equipment differed from the earlier designed unit, in that the tower was packed with wooden slats, over which the water trickled in thin films from which gases


LINE DRAWING SHOWING DEAERATING TANK & SLAT-PACKED TOWER CONSTRUCTION FOR DEAERATING WATER SUPPLIED TO GRANDE ECAILLE MINE OF THE FREEPORT SULPHUR COMPANY.
NOTE: DESIGNED CAPACITY 4.09 MILLION GALLONS PER DAY INSTALLED APRIL 2, 1935.
SUCTION LINE TO VACUUM PUMP
DISTRIBUTING PANS
SLAT BUNDLES
20"
18'-0"
8'-6"
ORIFICE LEADS TO PROPORTIONER CONTROLS FOR REGULATION OF SODIUM SULPHITE SOLUTION
POINT OF APPLICATION OF SODIUM SULPHITE
RESERVOIR LEVEL
BY PASS
TO SUCTION PUMP
S. T. POWELL

Section Through Deaerator and Piping Arrangement.

were readily released. Experiments were made to determine the oxygen removal resulting when the water was dropped from various heights and when different degrees of vacuum were maintained. These tests showed that approximately 95 per cent oxygen removal from the water was effected [0.33 p.p.m. residual oxygen] when the deaerating chamber was under a vacuum of 28.5 inches. The curve of oxygen removal becomes almost horizontal at this vacuum and further reduction in pressure requires rapidly increasing pump capacity because of the much larger volume of the rarified gases under the lower pressure. It was determined that the remaining 5 per cent of dissolved oxygen could, therefore, be removed most practicably and economically by means of the deoxygenating sodium sulphite than by extending the mechanical process. The type of deaerating unit constructed as the pilot plant was a much less expensive form of construction than the Australian apparatus, and since excellent results were obtained, it was used as the pattern in designing the full-scale plant.

Water deaerated by the pilot plant was passed through a 4-inch discharge line for a period of three months. At the end of this period the line was inspected and sections of the pipe were cut longitudinally. No tuberculation was found and by comparison with control specimens carrying undeaerated water, it was obvious that corrosion was almost entirely inhibited. In each case portions of pipe from which the mill-scale had been removed by pickling were inserted in the line. This was done in order to evaluate the harmful effect of mill-scale on past operation. The pipe which contained mill-scale was much more seriously attacked by water with normal oxygen content than was the pickled (cleaned) specimen. With deaerated water, however, the corrosion was very slight, even in the presence of mill-scale, although it was apparent that pickling had been of some benefit in this case also.

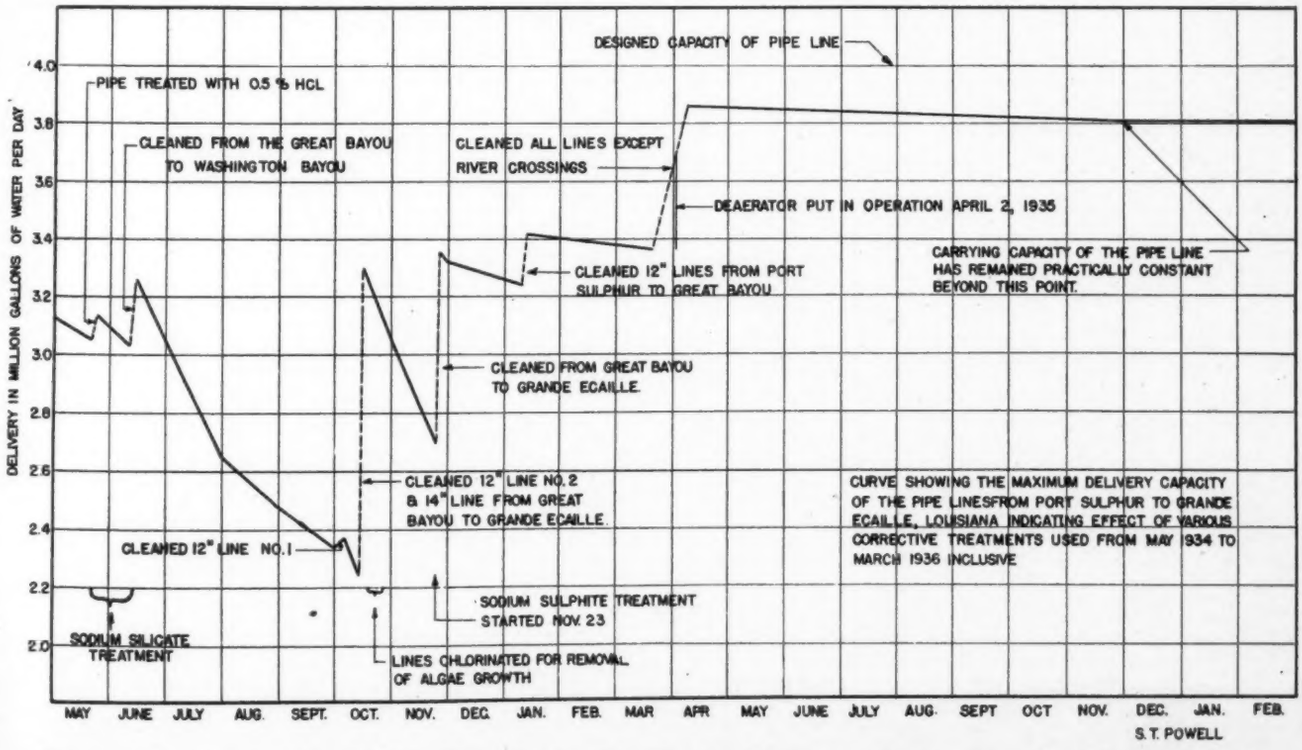
Plant Scale Installation

Observations on the pilot plant and calculations for a full-scale unit were so encouraging that a large deaerator was constructed, capable of treating the entire supply of 4,000,000 gallons per day, for which the pipe line was designed. The deaerating apparatus is illustrated in the accompanying sketch and photograph. It will be noted that the vacuum maintained is sufficient to draw the water from the reservoir into the deaerator. The water is distributed over the slat bundles by two perforated pans and is discharged to the suction of the pump feeding the pipe line. Sodium sulphite is applied at a point between the deaerator and the pumps. This chemical is fed by means of a Cochrane proportioner. The water is pumped through the 9-mile line by three 10x8-inch HYC two-stage Allis-Chalmers centrifugal pumps. A Worthington 18x7-inch dry vacuum pump, with an overall efficiency of 39 per cent, is used for maintaining a vacuum of 28 to 28.5 inches in the deaerating tower.

Results of Treatment

The results of this treatment and the entire history of the pipe line are strikingly illustrated in the chart picturing carrying capacities. It will be noted that since the deaerator was put into operation in April, 1935, decrease in carrying capacity has occurred at a very slow rate and at the present time this curve has become practically horizontal. The pipe line has been inspected at several points and it is apparent that tuberculation has been almost entirely stopped. It is therefore believed that deaeration of the cold water is an entirely satisfactory solution to the very serious problem with which this company was faced. Moreover, this installation has afforded a practical demonstration of the feasibility of mechanically deaerating even large quantities of cold water where the protection of pipes of ferrous material is desired.

Acknowledgment.—We wish to express our appreciation of the assistance and co-operation of W. T. Lundy, Vice-President and General Manager, and Homer S. Burns, Vice-President, of the Freeport Sulphur Company, which have made the project a success and this article possible.


DESIGNED CAPACITY OF PIPE LINE
PIPE TREATED WITH 0.5 % HCL
CLEANED FROM THE GREAT BAYOU TO WASHINGTON BAYOU
CLEANED ALL LINES EXCEPT RIVER CROSSINGS
DEAERATOR PUT IN OPERATION APRIL 2, 1935
CLEANED 12" LINES FROM PORT SULPHUR TO GREAT BAYOU
CARRYING CAPACITY OF THE PIPE LINE HAS REMAINED PRACTICALLY CONSTANT BEYOND THIS POINT.
CLEANED FROM GREAT BAYOU TO GRANDE ECAILLE.
CLEANED 12" LINE NO. 2 & 14" LINE FROM GREAT BAYOU TO GRANDE ECAILLE.
CURVE SHOWING THE MAXIMUM DELIVERY CAPACITY OF THE PIPE LINES FROM PORT SULPHUR TO GRANDE ECAILLE, LOUISIANA INDICATING EFFECT OF VARIOUS CORRECTIVE TREATMENTS USED FROM MAY 1934 TO MARCH 1936 INCLUSIVE
CLEANED 12" LINE NO. 1
SODIUM SILICATE TREATMENT
SODIUM SULPHITE TREATMENT STARTED NOV. 23
LINES CHLORINATED FOR REMOVAL OF ALGAE GROWTH
DELIVERY IN MILLION GALLONS OF WATER PER DAY
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR APR MAY JUNE JULY AUG. SEPT OCT NOV. DEC. JAN. FEB.
S.T. POWELL

History of Carrying Capacity of 9-Mile Water Supply Main Showing Efficiency of Various Corrective Measures Applied.

Water Works and Sewerage—April, 1937

THE ALGAE STRAINER

By HARRY U. FULLER

Chief Engineer,
Portland Water District, Portland, Maine

I HAVE been assigned the job of explaining what we are aiming to accomplish with what we choose to call our algae strainer.

First, I think we should discuss "What are algae?" In this, I will not try to be scientific, but rather will try to paint for you a general picture of what is going on.

Algae are small plants. They differ from microscopic bacteria, which are also members of the plant kingdom, but it is also true that some algae are so small that only the largest species can be distinguished without a microscope. They live in the water and, having practically the same specific gravity, there is little tendency for them either to rise or sink. When they die, many either float to the surface or sink. When they decay or disintegrate is when we have our *real* troubles.

When the water warms up to a certain point, algae multiply rapidly. A good way to describe to you their effect in the water is to state that in May or June, if you go out in a boat to the end of our intake pipe at Chadbourne's Landing, you will be able to look down through the water, which has a general crystal clear appearance, and see the bellmouth of the intake pipe. At that time you are looking through 25 feet of water. If, however, you go out there in September to look down, you will find that the water has a general blue-green tinge, and that you will only be able to see into it perhaps 10 or 15 feet. The reason for this change in color and clarity is the vast number of small algae in the water.

The Consequences of Algae and Amorphous Matter

In addition to the algae there is in the water what is known as amorphous matter. Amorphous means without shape. Amorphous matter is any disintegrated foreign substance in the water but is, in our case, largely decomposed humus-like vegetable matter. Some of it may be disintegrated algae, leaf molds or roots.

The reason we are concerned about algae and decomposed vegetation in the water (amorphous matter) is not merely the appearance that it has. Experience shows that one pound of chlorine for each million gallons of the crystal clear water in the winter time is sufficient to make it sterile at a point just below the point of application; but, in the summer time, it requires 4 or 5 pounds of chlorine to the million gallons to produce sterile water. The reason for this is that most of the chlorine is consumed in oxidizing extracts in solution, and algae and amorphous matter. After this, a very little extra is required to kill the bacteria that may be present.

It has been found that in spite of the fact that the water is sterile after it has been chlorinated at the lake, it is not sterile when it reaches the Portland distribution system. This means that there is in the pipe system in Portland vegetable matter which has come down with the water and has settled in the pipes, and this vegetable matter makes excellent food for bacteria under summer conditions. Some bacteria have probably gotten by the chlorinating machine, at some time, without being killed, although the chemist in his tests finds the water sterile shortly after chlorination. Some computations indicate that about a thousand pounds of vegetable matter comes down into the Portland Water District system daily. Part of this is drawn from faucets and part of it settles out in the pipe system and supplies food for bacteria which multiply therein. There are many reasons to believe that such action is the source of aggravated corrosion troubles.

It is the ordinary practice to kill algae at the source with copper sulphate or chlorine. Sometimes this improves the taste and sometimes it makes it worse, depending on the particular type of algae and how early in its life cycle it is destroyed. Even then enough chlorine must be applied to the water to oxidize the algae.

Advantages to Water Cleansing

It is obvious that there would be advantages to straining the algae and amorphous matter out of the water instead of chlorinating or killing it and sending it down to be consumed by the water taker. The question raised was, could it be done by some mechanical water strainer, of the nature of a filter, and at a price that was not too great.*

Rates of flow in all of the orthodox rapid filters do not appear to be high enough to permit their use for straining algae or amorphous matter out of the water at a cost that the ordinary water works can afford to pay. The generally accepted rate of flow for rapid sand filters is 2 gallons per minute per square foot, although there is a recent tendency to approach a 3 gallon rate. However, these rates are attained with the aid of preliminary coagulation and settling. Such filters will remove algae as well as bacteria, but many water works cannot afford to use them for algae or amorphous matter alone where the quality of the water does not continuously require their use for this purpose alone or for the removal of non-pathogenic bacteria in addition. It is well to draw a distinction between cleansing a safe water and the rendering of an unsafe water clean, or more safe than clean in many instances.

Some time ago Mr. Everett, our consulting engineer, reported that there was in the market a self-cleaning filter called the Laughlin Magnetite Filter. This apparatus consists of a bed of magnetite sand a few inches thick, resting on a bronze screen. The water flows upward through the filter bed or the process can be reversed if desired. Mr. Everett reported that tests of this sand in glass tubes with Rahway River water, which contains considerable algae, gave very favorable results, and advised the making of experiments with this Laughlin Magnetite Filter at Portland. He suggested that the Water District install a plant similar to one which had been working at Coney Island, N. Y.

Trials With the Magnetite Filter

Filtration Equipment Corporation, of New York City, who make and sell the magnetite apparatus, has sup-

*"The Author" of this article has the distinction of being President of the New England Water Works Association and has served as President of the Maine Water Utilities Association, before which this paper was presented.

*This question was raised in an article by the author which appeared in the September, 1936, issue of this magazine under the title, "What Is Clean Water?"—Ed.

plied the essential machinery required and the Water District built the required iron tank 10 feet long, 18 inches wide, and about 4 feet high, and installed the necessary pipes and electrical service.

Magnetite sand is black sand made from magnetic iron ore. It has the power of being attracted to a magnet. When the sand bed requires cleaning, an electrically operated traveling caisson containing a solenoid and pump moves automatically over the bed. The solenoid picks up the magnetic sand, which is washed by the up-rush of the water. When the electric current is released, the cleaned sand falls back to its former position on the bronze screen. The small quantity of dirty wash water from the pump is wasted. The whole cleaning apparatus is automatically operated. When the head is increased by increased deposits in the sand bed, the cleaning apparatus begins to function; and when the bed is clean, it automatically stops.

This apparatus was first developed for use in industrial plants and sewage plants where comparatively dirty liquid was to be cleaned and the loadings imposed were great. Its use in making comparatively clean water cleaner was something new and considerable experimentation will likely be required to learn the limitations of this type of strainer. However, the results at Portland have been very favorable up to date. Three-quarters of the vegetable matter has been taken out of the water at a high rate of up flow through the shallow and relatively coarse grained bed.

Our experiments have not been carried far enough to warrant the quoting of figures. And, we believe it to be desirable to learn the results from both upward flow and downward flow through the sand. Also, the result from various sizes of sand and thicknesses of bed must be determined for varying rates of flow in each case. With this information it will be possible to design the most economical water cleansing mechanical strainer, learn the cost of construction and yearly expense, and then judge whether the results will justify the costs.

(*The above paper has been released by Mr. Fuller to* WATER WORKS AND SEWERAGE, *with approval of the Maine Water Utilities Association. It is presented as a progress report which follows as a consequence of his earlier article "What Is Clean Water?" in our September* 1936 *issue. At the proper time, before snow flies in Maine, Mr. Fuller will have more concrete results to record and* WATER WORKS AND SEWERAGE *has been accorded the privilege of publication. We will learn then "What Clean Water Is—What It Means—What It Costs."—Ed.*)

▼

Unique Sewer Construction

In the 1936 construction of Cleveland's Big Creek Intercepting Sewer, the crossing of two ravines and maintaining an all-gravity flow sewer was one of the problems. Instead of constructing costly inverted syphons of questionable hydraulic characteristics, grade crossings on trestle were decided upon. The accompanying picture shows one of the structures and type of construction, which involved the use of plates of Byer's Wrought Iron welded, locally, into pipes of 60-inch diameter and jointed with friction type flexible Dresser Couplings, each serving as its own leakproof expansion joint. One of the crossings involves 142 feet and the other 194 feet of elevated exposed sewer, each being of practically identical construction. For appearance and heat repellant qualities the structure was finished with aluminum paint.

Big Creek Intercepting Sewer

During the past year 8,325 feet of sewer was constructed, making a total of better than 30,500 feet in the Big Creek Interceptor as built to date. Temporarily the sewer stops at the Cuyahoga River, but will be extended to the enlarged Southerly Treatment Works. Such will involve a bridge crossing of the river, involving a 1264-foot additional run of elevated sewer and 4000 feet of sub-grade sewer 6 ft. 3 in. in diameter beyond.

(For the above information, we are indebted to S. H. Murdock, Engineer of Construction, Department of Public Service, Cleveland, Ohio.—Ed.)

▼

Thomas and Thomas of Pasadena and Pasadena (A Correction)

On page 95 of our March issue, in reporting the award of honorary degrees conferred by Johns-Hopkins University recently, we are informed of an error.

In a letter from Franklin Thomas, head of the Department of Civil Engineering of California's Institute of Technology at Pasadena, Calif., we learn that there was confusion in recording the awards. The degree was conferred on Carl C. Thomas, Consulting Engineer of Pasadena (for a number of years professor of mechanical engineering at Johns-Hopkins University), not to Professor Franklin Thomas, as reported. The mistake was occasioned by confusing Pasadena's Thomases. To both, our apologies for the error.

While Professor Franklin is disturbed over the error, Doctor Carl writes: "I should be honored to share any favorable recognition that might come to me with my old friend and co-worker. So far as I am concerned, I should be happy to have the notice remain uncorrected. You were just giving 'honor where honor is due.'"

Why can't everybody be that way? We salute you, Doctor Carl.

▼

HOUSTON, TEX., VOTES $4,100,000 BOND ISSUE—Citizens of Houston, Tex., on April 2 voted a $4,100,000 bond issue, $1,000,000 of which is for sewers.

Water Works and Sewerage—April, 1937

N.E.W.W.A. HANGS OUT RECORD FOR WINTER MEETINGS

WITH an accurate count of 243 at the Luncheon Session of its March 18th meeting in Boston, the New England Water Works Association hung up a new record for its Winter Meetings, held monthly.

The feature of the morning session was the hour devoted to "The Water Works School" in which one of a series of lectures on "Water Works Hydraulics" was given by George E. Russell, Professor of Hydraulics at the Mass. Inst. of Technology, who discussed the "Venturi Meter" in principle, theory and practice. The feature of the afternoon session was the symposium of five papers dealing with "Transite" Pipe, and experiences with its installation and service, by engineers and operators. Paralleling the customary forenoon Round Table for Superintendents, the chemists and bacteriologists staged the second Chemists' Round Table.

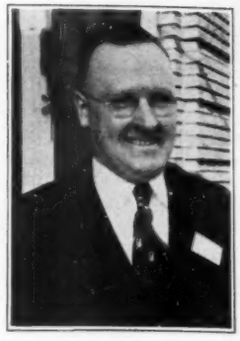
Professor Russell on Venturi Meters

In an easy to follow manner, Professor Russell discussed the principles and theory involved in Venturi type meters, their installation and maintenance. For highest accuracy and dependability, he stressed the number one requirement; that only straight line flow approach the meter and the consequent need for having a length of straight run pipe, without fittings or valves, for a distance ahead of the meter equal to not less than 15 pipe diameters. To his mind a clear run of 25 pipe diameters constituted a more dependable practice and insured higher accuracy. Troubles with Venturi meters had actually been traced to tuberculation of the approach pipe and it was important that it be kept free of tubercules if the original coefficient ("C" value) of the Venturi tube, and therefore accuracy, was to be maintained. Strange to many, he repeated that little matter what happened to the water immediately beyond the meter and the design of the take-off piping and valving made no difference. With approach precaution the Venturi tube gave the same accuracy in any position, horizontal to vertical. Percentage errors between 3 and 5 per cent were to be expected and the greatest errors appeared during lowest flows in measuring and recording resulting in low head differentials between the approach and throat of the tube. Professor Russell described the adaptation of the mercury U tube differential gage for greater accuracy and for meter testing. In measuring the lower differentials an inverted U tube was used and gage fluids lighter than water were used to magnify the differential and enhance reading accuracy. The most common fluid was tinted kerosene oil which was always used in making surveys for leakage with the Pitotometer.

Harry U. Fuller

Asked if the injection of chemical feed solutions into the throat of a Venturi tube at right angles to flow would create meter inaccuracy, Professor Russell said not, unless the throat ring be attacked by the solution, and even a small amount of air entering at the throat would not affect the accuracy of the meter. Professor Russell announced that in the next lecture he would discuss other types of meters.

H. L. Field, Supt., Greenfield, Mass., Superintendent's Round Table Leader.



Dr. Gail P. Edwards, Mass. Dept. of Health, Chemist's Round Table Leader.

Superintendent's Round Table

(H. L. Field, Greenfield, Mass., Presiding)

In the Superintendents' Round Table the following questions came up for discussion:

Can Water Departments Be Managed and Operated on a Sounder Business Basis?

Introducing this topic, Mr. Field pointed out that it was difficult to understand why a $30.00 a week city purchasing agent should be responsible for the ordering of water works materials. Another question was, why should water works income be diverted to the general fund to reduce taxes?

H. L. BRIGHAM (Marlborough, Mass.) stated that he figured that, in Marlborough, water revenue equivalent to a $1.35 tax rate had gone into the general fund during the past year and a total transfer of $500,000 from water receipts could be accounted for over a period of years. In the face of this, it was hard to get approval for purchase of needed equipment for the most efficient operation. He could see no reason to penalize the water user in favor of the tax payer, other than the fact that improved water service did not bring votes, whereas tax reduction did. Mr. Brigham pointed out that publicly owned electric and gas utilities were not so much interfered with and the manager received recognition for efficient management and reduced rates resulting therefrom. He saw no reason to differentiate between management of water works and other public utilities.

CHARLES EASTER (Claremont, N. H.) explained that he was more fortunate than most superintendents. In Claremont a three man commission operates the water utility divorced from political hamperings. With funds kept separate, they operate on a pay-as-you-go system except that major betterments had to be financed through bond issues retired serially. With some satisfaction he said that for 1936 only $4.00 remained as uncollected water bills.

PATRICK GEAR (Holyoke, Mass.) insisted that he represented "a municipally owned plant but privately operated." The Water Department pays taxes and also office rent, but insists on being paid for all water used by the city amounting to roughly $15,000 per year (including hydrant rentals at $18.00 each) which went to build up a $30,000 to $40,000 net water profit at the

end of the year which the city could not touch. Water works employees came under civil service. Interesting was the fact that tax boosting at one time about had the Water Department "licked," so to the Legislature they went to "get that matter fixed up."

D. A. HEFFERNAN (Milton, Mass.), being asked for an expression, said that his department was little interfered with and was practically self sustaining, but they were asking for a needed hydrant rental boost to $35.00 as a fair charge, based on analysis of costs.

DAVID MOULTON, Attorney, Portland (Me.) Water District, in reply to a call from the Chair, said that he wondered why "The Man from Maine" should be called to tell Massachusetts that it definitely needed legislation to assist water departments and protect water managers. In Maine the political problem had been gotten rid of by legislative establishment of Water Districts. These were managed by 5 man commissions and subject only to regulation and mandate of the Public Service Commission. He failed to see why water takers should be required to bear the burden of paying charges incurred for fire protection, representing interest and depreciation on 50 per cent of the value of the system. There was no more reason than that they should pay for the maintenance of fire fighting departments in addition, and make it complete.

In reply to a question, he explained that any one or a number of communities or towns, upon vote of the people, could secure a Water District Charter from the Maine Legislature. The Water District thereby became a legal political sub-division of the state with privilege (subject to Public Service Corp. approval) of issuing bonds for water works facilities. Such bonds enjoyed the same status as general obligation bonds. In the Portland District there were 16 towns represented and a recent bond issue of $500,000 had been sold at a 2¼ per cent interest rate. Mr. Moulton was strong in his belief that N.E.W.W.A. could assist Massachusetts water works managers to obtain more business-like management of the water utility. He suggested that a committee, if taking "one bite at a time," with legal advice and diplomatic presentation to municipal and legislative authorities could get the situation corrected.

LINN H. ENSLOW (New York), directing a question to the floor, was informed that in Massachusetts the issuance of revenue type utility bonds, to finance water works and sewerage betterments, was not legal. Consequently, except for revenue anticipation warrants, financing had to be limited to the legal ability of the community to issue general obligation bonds, subject to a vote of the people.

Are Water Works Managers and Operators Adequately Compensated for Responsibility Assumed? Should Managers Demand More Skilled Assistants?

In discussing these questions it was pointed out that water works superintendents were in every sense managers but too frequently their hands were tied by elected officials who interfered. In other instances water superintendents' salaries were fixed by ordinance. In too many instances initiative was destroyed and business efficiency in management blocked because there was no outlook for appreciation or reward. Managers of publicly operated gas and electric utilities suffered less interference and received greater recognition. The question was raised as to "Why?" should this be and why should an electric utility manager receive $4,000 annual salary, whereas the water works superintendent in the same municipality received only the $3,000 limit set by ordinance. Why should the electric utility manager be given credit for efficient operation and allowed to reduce rates when the same were denied the water utility head? These were pertinent questions of Mr. Field, and several members, which came about as the result of conditions that N.E.W.W.A. and other water works associations could profitably attempt to have corrected for the benefit of the entire water works fraternity, and also the people served.

It was conceded that the several questions up for discussion were so inter-related as to say that answering one answered all; and, after hearing from a municipal gas and electric utility manager, who felt that the water works fraternity had been too little appreciated and demanded too little, it was the expression of the meeting that the suggestion of "The Man from Maine" should be followed up. The matter of establishing a special committee in N.E.W.W.A. for the purpose of securing more business-like management and operation of publicly owned water works, and betterment of conditions for water works operators, was endorsed and referred to the executive committee for consideration and action. In this move, due consideration was given to the work of existing committees on legislation, finance and management which might be revamped and given an enlarged scope to preclude conflict.

Harold L. Bingham, Supt., Marlborough, Mass. Complimented for his membership work.

Arthur C. King, Supt., Taunton, Mass. Reported as Chairman of Legislative Committee.

"The Man from Maine" and Two Secretaries

David E. Moulton, Attorney, Portland (Me.) Water District; Earle A. Tarr, Secretary, Maine Water Utilities Association, Winthrop, Maine; Frank J. Gifford, Secretary, N.E.W.W.A., Boston.

Chemists' Round Table*

(Dr. Gail P. Edwards, Mass. Dept. of Health, Presiding)

Three topics were presented by Dr. Edwards and discussed by members attending the Chemists' Round Table.

"What Causes Corrosion of Water Pipes. What Can Be Done to Prevent It?"

MR. TRAEGER, New Hampshire Board of Health, was particularly troubled with corrosion in connection with

Prof. Geo. E. Russell, Mass. Institute Technology. Lectured Interestingly on Venturi Meters.

Wm. J. Lumbert, Supt., Scituate, Mass. Invented a well screen from Transite Pipe.

the smaller water supplies. While cement-lined and cast-iron pipes gave satisfactory service when used to conduct soft ground waters, brass pipe could not be used in certain cases and water conducted through copper and lead pipes sometimes contained these metals in quantities considered to be harmful. He quoted the content of copper in the water as varying at times from 0.5 to 3.0 p.p.m. In giving advice as to the kind of pipe to use, he considered such laboratory tests as hardness, pH and alkalinity, and inquired as to what were considered the proper tests to make in determining the kind of pipe to use.

Dr. Edwards replied, that when the results of numerous analyses made by the Massachusetts laboratories for carbon dioxide, dissolved oxygen, alkalinity and hardness were studied in connection with the information available as to the action of the water on pipe it was found that where one municipality for instance had trouble with brass pipe, another municipality with a similar water reported no trouble. He concluded that it was difficult to determine the kind of pipe to use from the analysis of the water taken alone.

MR. COBURN, Chemist for Metcalf and Eddy, Engineers of Boston, found that valuable information could be obtained by placing wires of various kinds in samples of the water under consideration and studying the effects of varied corrective treatment on the particular water.

MR. HOWARD, Whitman & Howard, Engineers of Boston, had found that cold tar, properly applied to cement-lined pipe, would solve some of his problems, while Mr. MacKenzie, Southington, Conn., agreed that this was his experience, provided that the coating was thoroughly dry before the pipe was used.

MR. MACKENZIE then referred to a complaint in regard to the use of a brass service pipe in connection with a copper hot water tank, whereby the water in the tank had to be drawn off daily, while a copper tank next door gave no trouble. He was still seeking a satisfactory explanation. Dr. Edwards stated that much of the trouble experienced by the Hackensack Water Company was thought to be due to electrical contacts. Mr. Harrington, Massachusetts Department of Public Health, suggested that in regard to Mr. MacKenzie's trouble the use of dissimilar metals might be the source and referred to certain Massachusetts experiments where bakelite inserted between dissimilar metals improved such conditions by defeating the electrolytic cell phenomena resulting from abutting dissimilar metals.

MR. HARRINGTON, Mass. Dept. of Health, in reviewing the quantities of copper found in the water by Mr. Traeger, referred to certain Massachusetts experiments in regard to electric contacts whereby it was found that as little as 0.1 p.p.m. of copper in the water produced stains on clean marble. The experiments showed that by increasing the flow of the current as much as 6.0 p.p.m. of copper was driven into the water.

MR. MAWNEY, Department of Public Works, Attleboro, Mass., described briefly the recent installation of an "Aer-o-Mix" aeration unit and facilities for applying lime treatment to the water pumped at the South Attleboro pumping station for low pH and high carbon dioxide correction.

"Where Would You Find Iron and Manganese in Natural Waters? How Would You Remove These Substances from Water?"

Mr. Clark, Sanford (Maine) Water Company, reported that a yeast manufacturing company using about 100,000 gallons of water per day, high in iron and manganese, satisfactorily removed these minerals with a zeolite. In answer to his question as to use of such plants in Massachusetts, Mr. Bogren, Chemist of Weston and Sampson, Engineers of Boston, referred to a small satisfactorily-operated plant used in connection with a private house system in Concord. Dr. Edwards, in answer to a question, stated that potassium permanganate was used for regenerating the zeolite at the rate of 1/100 of a pound per 1,000 gallons of water used.

Questioned as to the allowable amount of manganese in water before it is considered objectionable, Dr. Edwards suggested that the iron and manganese together should not exceed 0.3 p.p.m. Mr. Traeger referred to complaints in regard to the presence of 0.15 p.p.m. manganese in water and to the lack of complaints on other occasions when as much as 0.35 p.p.m. of manganese were present.

"What Precautions Should Be Taken in Handling Chlorine and Ammonia?"

Mr. Pratt of the Wallace and Tiernan Company suggested that it was unwise to have gas masks in the chlorinator house as is sometimes done and that cannisters should be changed every six months and especially after use. The mask itself should be tested carefully for leaks. He warned against letting small leaks grow and suggested that when a gas mask is not available much can sometimes be done while a person simply holds his breath.

*For the recording of the discussion in the "Chemists' Round Table" we are indebted to Mr. Wm. R. Clary, of the Mass. Department of Health, and to Dr. Edwards for arranging for such. —Ed.

Luncheon Session

At the Luncheon Session, President Fuller announced the recent death of two valued members—J. W. Killam of the Boston Metropolitan Water District, for 30 years a member, and Dr. A. D. Flinn, eminent water works engineer and author, of New York City.

A. B. Rich, Cons. Engr., Boston. Chas. Easter, Supt., Water, Claremont, N. H. (For 1936 only $4.00 in water rents uncollected.) Chas. W. Sherman, Metcalf & Eddy, Boston. (Reviewed Underwriters Report on Transite Pipe.)

Frank Gifford, in making his brief Secretary's report, complimented Harold Brigham for his effective work as Chairman of Committee on Membership and Mr. Brigham followed with an effective "sales talk" on what the association had to offer its members and told something of proposed activities to which every water works man should lend his support and backing by becoming a member of N.E.W.W.A. if not already so.

Arthur C. King (Taunton, Mass.), reporting as Chairman of Committee on Legislation, revealed that the Massachusetts law holding unpaid water bills a lien on the property served was up for repeal and would likely be killed. Massachusetts bills making mandatory the licensing of engineers operating combustion engines had been adversely reported on by the committee. The same was the fate of the bill giving water departments jurisdiction over plumbing regulations in building construction and owners' services. He commented on the welcome news of the U. S. Supreme Court's decision that water works employees' salaries were not subject to the Federal income tax.

The afternoon program of papers opened with an illustrated talk on **"The Control of the Gypsy Moth in Watershed Forests,"** by A. C. CLINE, Assistant Director of Harvard Forest, Petersham, Mass.

Mr. Lumbert told of the successful use of Class "C" Transite pipe (1.44 in. thick) for well pipe and strainers in the construction of gravel packed wells of various diameters. Aided by illustrations, he explained how the pipe had been jointed with Transite Simplex Couplings as rapidly as lowered. To prevent gasket ring slip, the couplings being fixed to abutting pipes, by drilling through coupling and pipe end, and placement of 12 staggered screws in two rows in each pipe end. Each 16-inch joint was completed by 3 men in two hours. The strength was indicated by the fact that the upper coupling held a 4600-lb. 60-foot string of 16-inch pipe weighing 70 lbs. per foot, and couplings weighing 100 lbs. each.

The ingenious screens (an invention of the author) were made up of rings sawed from Transite pipe and notched so as to give sloping slots between abutting rings. The effect produced was that of a Louvre screen. The angular tapered ports formed were for the prevention of entrance of gravel and the total area opening amounted to 33 per cent of the pipe area. The string of abutting rings were held together by long concealed bronze bolts, through holes drilled lengthwise through the walls of the pipe rings. By test, the coupled Transite well pipe had stood 23 inches of mercury suction.

A Shot in the Dark, or The Experiment That Flopped

1. Geo. A. Caldwell (Himself), Mattapen, Mass.; 2. Roger Oakman Supt., Needham, Mass.; 3. J. W. Wickwire, General Mgr., Edson Corp., South Boston; 4. Fred E. Smith, Supt., Filtration, Cambridge; 5. H. W. Jacobs, Gen. Mgr., Cement Lined Pipe Co., East Lynn; 6. Harry Huy, Federal Water Service Co., New York City; 7. Stuart Coburn, Chief Chemist, Metcalf and Eddy, Boston.

Symposium on Transite Pipe

(President, Harry U. Fuller, Presiding)

"The Adaptation of Transite Pipe for a River Crossing"—By FRANK A. MARSTON, Metcalf and Eddy, Engrs., Boston, Mass.

Mr. Marston's effectively illustrated presentation described novel methods used in installing a 500 ft. river crossing at Scituate, Mass., involving 10-inch Class D. "Transite" pipes jointed with flexible rubber ring gasketed flanges, also of "Transite." The pipe, selected for its corrosion resistant qualities, was jointed at the shore and pulled across through the trench in the bottom of the river on temporary wooden sledding. The pipe was weighted down with concrete blocks formed by filling cement sacks with mortar which saddled the pipe crosswise and took the shape of a sack of meal mule-back. Later the trench was filled. The Transite flanges were bolted with plated metal bolts, finally coated to preclude corrosion. Testing for leakage at 125 lbs. pressure, only 10 per cent of that allowable was observed. Further, a severe water-hammer had failed to damage the joints or the pipe as shown by further leakage tests. The river crossing project had cost $6,000. A recent inspection of the Scituate pipe buried in a marsh had revealed no attack on the Transite.

"The Use of Transite for Well Pipe and Screens"—By WM. J. LUMBERT, Superintendent of Water, Scituate, Mass.

Being corrosion proof, blinding of the well screen was a difficulty not to be feared.

[Without the aid of such illustrations as were used by Mr. Lumbert, the ingeniousness of his strainer is difficult to portray by words alone.—ED.]

"Experiences with Transite Pipe"—By A. B. RICH, of Fay, Spofford and Thorndike, Engrs., Boston.

Mr. Rich, in describing this asbestos reinforced cement pipe, ascribed the strength of Transite pipe to the long fiber asbestos reinforcement. He then related his experience. In jointing, the Simplex coupling had only one weakness in that clay on the rubber rings caused them to slip, instead of roll into place. Being much lighter than iron pipes, weighting down in wet trench was essential. Being more fragile, greater care had to be exercised in bedding under the pipe and back-filling. Stones dropped onto the pipe showed little damage outside but created blisters inside. To preclude joint slippage, the effective shoring of bends and tees had proved essential. Tapping and threading of the pipe were nowise different from cast-iron pipe. Tests had revealed friction coefficients of C-150 on straight pipe runs and 145 with fittings in the line.

On a project involving 19,000 ft. of pipe and 1607 Simplex Couplings, only two of the latter had been defective and leaked under 80 to 175 lbs. pressure. Of 3,214 rubber gasket rings, only 3 had blown out. Out of the 1,839 lengths of pipe, 33 had proved defective

and failed. Mr. Rich said that it was his opinion that factory testing at 260 lbs. per sq. in. for pipe to stand 130 lb. field pressure was insufficient. He suggested a 600 lb. factory test in order to take into account the external trench loading and stresses non-existent in factory testing. Furthermore, repeated stresses would create failures at constantly lower pressures.

In summing up, Mr. Rich gave the attributes of Transite systems as: Less joint leakage, easier to lay and lighter to handle, freedom from depreciation due to tuberculation, desirable flexibility of joints, no deterioration of water quality, no rusty water with heavy flows, no electrolysis troubles. Disadvantages were that no rough treatment of Transite pipes in handling or laying could be tolerated, and a new care in pipe laying in this and other directions was therefore essential to its successful adaptation.

"Our Introduction to Transite Pipe"—By HAROLD L. BRIGHAM, Supt., Water and Sewage Commission, Marlborough, Mass.

Mr. Brigham gave a brief account of Marlborough's experiences in handling and laying of Transite pipe in rough trench, mostly blasted through rock ledge. To the trench, two men had carried 13-foot sections of 6-inch pipe as far as 500 feet. Care had to be taken in bedding the pipe with sand, from a nearby pit, tamped under the pipe and around it to the spring line with iron bars used for tamping track ballast. In 6 hours 500 ft. runs were laid, leakage test applied and 33 per cent backfilled. The line was tight at 130 lb. test pressure but a few broken couplings had to be replaced, requiring between 45 minutes and 1 hour to complete each replacement. Some of the pipe had been found to have dents and was rejected. Complaint of limey taste in water from the new pipe was corrected by bleeding.

"Underwriters Evaluation of Transite Pipe"—By CHAS. W. SHERMAN of Metcalf and Eddy Engrs., Boston.

Mr. Sherman briefly reviewed the report of Underwriters Laboratories, Inc., on Transite pipe released January 20, 1937, to cover Class 150 pipe, good for pressures up to 150 lbs./sq. in.

In summary, the report stated that Transite pipe had been found practical to handle and install, and seemed to have proven reliable and long lived in the ground. Conclusions reached, concerning 4 to 24-inch pipes (based upon surveys) were that these could be handled and installed without unusual breakage. From several installations, good service had been recorded and with reasonable care service connections had given no difficulties. The pipe would without doubt withstand corrosive water and oxidation. The history of rubber gasket joints under ground had been good. Concerning expected service, low friction losses would be continuous during life of pipe. Strength had met design requirements and, although the factor of safety had been less than other pipes, such a factor was on a par with gate valves. The pipe did not seem unduly susceptible to impact damage, so long as instructions be followed, and the product had been found uniform as to quality, dimensions and strength.

Adjournment

▼

"Dry Cleaning" Diffuser Plates (Addenda)

In our February issue (page 44), a brief article by A. M. Rawn, captioned "Dry Cleaning Air Diffuser Plates," related experiences at the Ontario, Calif., activated sludge plant, wherein oily smudge-pot smoke-fog from citrus groves (taken into the blowers) had caused serious inside clogging of the air diffuser plates. To relieve the condition, the expedient of slowly pumping into the air header pipe 2 gallons of "aviation" gasoline over a period of hours was tried. The results exceeded the best expectations and pressures dropped to normal. No harm to the activated sludge resulted.

In a letter from Austin Burt, Ontario's City Manager, and "inventor" of the successful "dry-cleaning" process, their experiences are brought up to date in reporting "We have had to apply our gasoline remedy to the diffuser plates *seven* different times during the more than two weeks of smudge conditions. Each time the pressure was brought back to normal, and thus far we have been unable to detect any serious consequences in the operation of the plant. Altogether, we used seven and one-half gallons of aviation gasoline at the total cost of only $1.16 and feel pretty good at saving the trouble and cost of emptying the tanks, removing and cleaning the plates."

▼

J. B. Baty Joins Penna. Salt

J. B. Baty

J. Bernard Baty for the past several years Assistant Sanitary Engineer with the New Jersey Department of Health, resigned April 1st, to accept a position with the Pennsylvania Salt Manufacturing Company. He joins the Technical Service Department of the company as assistant to L. L. Hedgepeth, head of the department and also a former State Health Department engineer and plant operator.

Mr. Baty is a native "Long Horn" from the Lone Star State where, after graduation in 1925 from Texas A. & M. College, he got his initial training under V. M. Ehlers, veteran State Sanitary Engineer. After two years of service he took up graduate courses at Cornell University, looking to the degree of Civil Engineering and specializing in water and sewage courses. In 1929 he joined the New Jersey Department of Health as assistant engineer on the staff of H. P. Croft, who has nothing but laudable praise for Bernard Baty's technical ability and, with it all, a steadiness of character and staunchness of loyalty.

Of him, his former teacher, Professor Chas. Walker at Cornell, under whom Mr. Baty served as instructor, says that his personality "curve" is of the constant type rather than the choppy temperamental type; is thorough in his work, keen, alert, ready for assignments "as they come."

To follow in the tracks of J. M. Potter, resigned, we felt that his successor would find the path an exacting one. But, knowing something at first hand of the capabilities of Mr. Baty, and hearing more from his associates, we feel that there is nothing but success ahead for him in his new work with the Pennsylvania Salt Company, which is to be congratulated on having secured the services of Bernard Baty as an addition to its technical service staff.—L. H. E.

▼

The State Department of Health of North Dakota has recently inaugurated Milk Control activities in addition to its work in Water and Sewage.

PRACTICAL HYDRAULICS

IV—Float Gages

By P. S. WILSON*

New York, N. Y.

This is the fourth of a series of articles by the author on selected phases of hydraulics, from the viewpoint of the practical water works operator.

Mr. Wilson's experience as a superintendent of water works and later as superintendent of operations of all Community Water Service Co. plants, fits him to contribute material of practical value.

His next article will deal with Pump Testing—The Why and How.

FLOAT gages are liquid level gages in which the indication of the height of the liquid is usually obtained by some mechanical device actuated by the movement of the float. They may be classified into two types. The simplest type consists of the float with a rigid vertical stem attached to and supported by the float, and with an index or pointer at its upper end. The gage reading is obtained from the position of this pointer along a fixed vertical scale. In the other type of float gage the motion of the float is transmitted to some form of indicating or recording mechanism by means of a flexible wire or tape.

The Float

A suitable float is the first essential. It must not become water logged, but must retain its buoyancy. To meet this condition a hollow sheet metal float is generally used, and copper is the preferred material because of its resistance to corrosion. The seams must be well locked and thoroughly soldered. Earthenware floats have been used in sewage or other corrosive liquids. Floats are most often made cylindrical with the axis vertical, in order to fit in a float pipe and for ease of construction. It is important to have the top and bottom dished outward so that the float cannot be weighted with water on top or lifted by air trapped beneath. The float should have at least three vertical fins projecting a half inch or more from its sides in order to prevent it from clinging to the wall of the float pipe or well. Sometimes a spherical float is used, but in that case its weight, or its counterweight, should be adjusted so that it will float near its middle in order to gain the maximum sensitivity.

Float Pipe

Floats are usually provided with some form of float pipe or stilling well. This serves two principal purposes—it serves as a guide for the float, and by adjusting the size of the communicating opening into the float pipe the effect of waves or surges upon the gage readings may be reduced. The use of a float pipe also makes it possible to locate the gage a short distance away from the body of water being observed, the level in the float pipe being maintained by a small size connecting pipe. With such an arrangement care must be exercised to avoid air traps in the connecting pipe. The connecting pipe should be made of non-corrosive material and should be provided with convenient means for flushing it out. A float pipe should be provided with a cover, having only a small opening for the wire or tape, in order to prevent objects from falling in and lodging on the float.

If the gage mechanism is light and easily operated a 5-in. diameter float in a 6-in. float pipe makes a good combination. If a high degree of sensitivity is desired, or if a recorder requiring some power to operate it is used, then a larger float is desirable, a 10-in. float in a 12-in. pipe, or even larger, being often used.

Gage With Rigid Stem

The type of float gage having a rigid stem is the simplest and is also probably capable of the closest reading with accuracy, since the only friction involved in its motion is due to whatever guides may be needed to keep the stem upright and in the correct position with relation to the scale. The effect of this friction in preventing accurate response of the gage to changes in the water level may be largely, if not entirely avoided by gently tapping the stem while reading the gage. Gages of this type if properly designed and constructed may be read directly to the nearest one thousandth of a foot (0.001 ft.), which is about the best in true accuracy that can be expected from single readings of any type of gage.

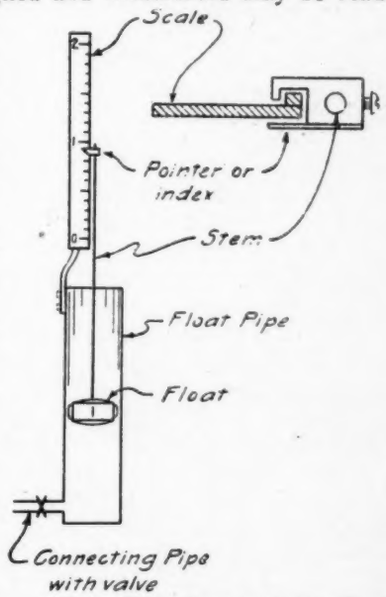


Fig. 1—Float Gage with Stem

An arrangement of this type of gage which has been used extensively,* and which is highly suitable for accurate weir head readings is shown in Fig. 1. In this design a 7-in. float may be used in an 8-in. float pipe. The float stem is a brass rod of about 3/16-in. or ¼-in. diameter, depending on the height. The best scale is made from a graduated brass strip about ⅛ in. thick. It is provided with a continuous projection along its back edge which serves to guide the index or pointer in the correct position for easy reading, and to hold the stem vertically above the float.

Gage With Flexible Wire

The second type of float gage, using a flexible wire or tape, is more adaptable to different arrangements since the motion is usually converted into a rotary motion by the wheel or drum on which the wire is wound and thus the readings may be shown on a circular dial, or a

*Assistant to the Secretary of the American Water Works Association.

*In the hydraulic laboratory at Cornell University.

recording mechanism may be operated. It is not always so simple to overcome the friction of motion in this type of gage and for that reason it may not be read quite so accurately unless the float is larger than with the rigid stem type.

A metal wire or tape is necessary for accurate readings in order to avoid changes in length due to stretching or moisture. The wire should be stranded, made from a large number of very small wires braided together, in order to be flexible and withstand frequent bending. Either wire or tape must be of bronze or other non-rusting metal.

The simplest arrangement of this type of gage consists merely of passing the wire over a wheel or pulley and having a counterweight on the end. Reading may then be taken from the motion of a pointer attached to the wire along a fixed vertical scale beside it. A very crude form of such a gage has often been seen on railroad water tanks.

A more usual arrangement in water works practice is to attach the end of the float wire to a drum around which it is then wound a number of turns. The counterweight is then hung from another wire similarly attached to the drum. By such design slipping of the wire is avoided and the revolution of the drum is a true measure of the change in water level. The drum is then connected to a rotating pointer on a dial or to a recording device. By introducing suitable gearing a wide range of float motion may be shown as only a part of a revolution of the pointer on the dial, or other variations may be introduced changing the scale of readings to suit the conditions and the requirements.

The drum upon which the wire is wound should be provided with spiral grooves to receive the wire so that it will be guided in a single layer and will not wind upon itself thereby changing the effective diameter of the drum and affecting the accuracy of the gage. If desired the drum receiving the counterweight wire may be smaller than the drum for the float wire, thereby resulting in a shorter travel for the counterweight where this is of any advantage. The counterweight should not become submerged, since its effective weight would thereby be altered, and the submersion of the float changed.

Gage With Tape

If a tape is used it is customary to provide it with uniformly spaced perforations which fall over similarly spaced projecting pins on the drum, thereby preventing slipping. A tape is of course not wound around the drum but merely passes over it once, with the counterweight on the end. The counterweight must then travel through the same range of motion that the float does.

Indicators and Recorders

Many good designs of indicating and recording instruments are commercially available for use with floats and which are adaptable to different conditions and requirements. Floats may also be utilized similarly to operate transmitters for long distance electrical transmission of gage readings, known as telemeters.

▼

Alfred D. Flinn Dead

Alfred Douglas Flinn (S. C. D.—D. E.) died at his home in Scarsdale, N. J., on March 14th as the result of heart disease. He was 67 years old.

He was best known in the water works field as co-author of the highly valued "Water Works Handbook" with Robert Spurr Weston and Clinton L. Bogert, both of whom survive the senior author. At one time he served as Managing Editor of "Engineering Record" (1902-1904) and later as Department Engineer for the Board of Water Supply of New York City, during which time (1905-1918) he had an active and important part in the construction of the Catskill water supply system. From that work he went to the Engineering Council as its secretary and in 1922 became Director of the Engineering Foundation, which position he held until his death.

He was born in New Berlin, Pa., was graduated by Worcester Tech., and began his career with Boston's Metropolitan Water Supply System (1895-1902). The degree of Doctor of Science was conferred on him by the University of Louvain (France) in 1927 and that of Doctor of Engineering by his *Alma Mater,* Worcester Polytechnic Institute, in 1932.

▼

An Interesting Development In Underground Leak Detection

By ROBERT M. BELL

Asst. Engr., Water Department, St. Louis, Mo.

For a century or more water works men have used many methods for locating underground water leaks.

All of these methods as evolved have used vibration and sound for locating the leak. The old method used was to hold a valve key or an iron bar between the teeth or put it to the ear. Later telephone receivers with a diaphragm were used. A score or more of electric devices of a simple nature have passed along. The World War produced the "Geophone." This instrument consists of two small seismographs with hose connected to earpieces. This instrument has been valuable for many years to water works men.

The advent of the audio amplifier gave rise to greater possibilities for leak detection and recently we learned of an amplifier for intensifying and evaluating sounds emanating from a water leak. This instrument is equipped with filters, eliminating vibrations above and below the frequency of a water leak. A meter for measuring this sound is a part of this instrument. Thereby a sure means of comparing sounds, obtained in the search for water leaks, is provided, and personal opinion as to sound quality and intensity is obviated in the new instrument.

In using the Universal Leak Detector, we can now be sure that a leak actually does exist on a supply pipe or main, without a doubt in our minds. The Universal Leak Detector for water works use embodies many essentials heretofore dreamed of by the leak hunter. A person who has worked all night with the old type instruments, and has tried to compare or define sounds in his own mind, can appreciate this new instrument. There remains no doubt as to just where the greatest sound is obtained.

St. Louis has the Universal Leak Detector complete. In St. Louis there are many streets which have two, three or four mains. This instrument is invaluable in determining which main is leaking. This saves labor of shutting valves for a test and much inconvenience to consumers. With the detector, we have been able also to settle disputes as to the existence of service leaks. The instrument has been in service here for only sixty days. Our engineers have done good work with this instrument and are becoming more proficient in the use of it.

We believe that there is much to be learned about leak detection. But the new instrument has simplified this problem greatly and certainly, to us, seems a very desirable and valuable instrument for the modern water works man.

OPERATING CONTROL TESTS FOR THE ACTIVATED SLUDGE PROCESS

—*Some Comments*

By T. R. HASELTINE
San. Engr., Kansas City, Mo.*

For the delayed printing of this article we owe the author an apology. Mr. Haseltine's contribution was received late in December, closely following two articles in this magazine by Mr. George Anderson, on the operation of an activated sludge plant to preclude sludge bulking; and, the operating control tests utilized.

In submitting his paper, Mr. Haseltine stated that it was "really a partial discussion of Mr. Anderson's logical and timely articles on the operation of the Rockville Center, N. Y., plant. His articles recalled to my mind certain experiences encountered, while operating the Salinas, Calif., plant from 1930 to 1933, that I considered might be of general use to operators of activated sludge plants."

To better and more effectively realize the full value of Mr. Haseltine's discussion, the reader should review the Anderson articles in WATER WORKS & SEWERAGE *for September and November,* 1936.

First Operating Requirement

THE first requirement of the activated sludge process is the maintenance of dissolved oxygen in the aeration tanks. As early as 1926, Harris, Cockburn and Anderson[1] stated this principle of the process very clearly. Their work proved that "the dissolved oxygen adsorbed by the sludge is a constantly decreasing amount from its contact with the inflowing sewage to its discharge from the reactivation channels. The *starting point* of the process of reactivation may be accepted as the point nearest the inflow of the aeration tank at which dissolved oxygen first appears. The degree of reactivation that takes place in the aeration tank is dependent upon the balance maintained between the supply of, and the demand on, the dissolved oxygen and the period of detention as timed from the determined starting point."

Every operator of an activated sludge plant must know that the process is dependent upon aerobic bacterial action. Therefore, it should be evident to all that the presence of dissolved oxygen in the aeration tanks is a prime requisite for the proper functioning of the process. In spite of its self-evident nature some operators may lose sight of this principle of the process, due perhaps to their efforts to comprehend and apply the never-ending stream of articles dealing with the relative merits of pH control, various types and designs of structures and equipment, or the use of chemicals as an adjunct to the process. It is, therefore, very refreshing to read Mr. Anderson's timely and extremely logical articles[2, 3, 4] on the operation and control of the Rockville Center activated sludge plant. It was those articles that led the writer to prepare the following discussion for publication in the same magazine that carried Mr. Anderson's two articles.

"Tapered Aeration"

The "tapered aeration" effect used by Mr. Anderson, while not new in principle, is worthy of far more widespread application than it now receives. The writer operated the Salinas, California plant[5] from 1930 to 1933. During that time we found, after extensive experimentation, that the best results were obtained by so adjusting the air distribution that (a) there was an appreciable amount of dissolved oxygen in the sludge reaeration compartments, (b) there was at least a small amount at the inlet of the aeration compartments, and (c) the dissolved oxygen gradually increased towards the outlet of the aeration compartments. This required the use of from 55 to 70 per cent of the total air applied in the first half of the aeration tanks. The percentage increased some with high sewage flows, low air supplies, or bulked sludge and visa versa.

Dissolved Oxygen Tests

To maintain "tapered aeration" it is, as Mr. Anderson points out, necessary to make frequent dissolved oxygen (D.O.) determinations throughout the aeration tanks. However, the writer marvels at the success of Mr. Anderson[4] in using the regular Winkler method for such determinations; first, because one would expect interference from nitrites and, second, because it has been our experience that the sludge floc adsorbed some of the reagents and masked the end point of the titrations. We doubt if the operators of many activated sludge plants would find the regular Winkler method satisfactory. The Report of the Committee on Methods of Sewage Analysis[6] states that "as a rule nitrites will occasion erroneously high results when present in amounts exceeding 0.1 p.p.m. of N. as nitrite. Interference due to nitrites may be expected in dealing with effluents from biological oxidation devices." Whenever the presence of nitrites is suspected the report recommends the use of the permanganate modification of the Winkler method. At Salinas our crude sewage had an organic-plus ammonia nitrogen content of about 65 p.p.m. Our final effluent usually contained from 0.2 to 3.0 p.p.m. of nitrite nitrogen. As might be expected we found the regular Winkler method valueless under such conditions; in fact, we had to use a double strength permanganate solution much of the time.

The accurate determination of the dissolved oxygen in the mixed liquor of the aerators is extremely difficult and requires special apparatus such as was devised by Theriault and McNamee.[7] They state that the usual technique of working only on supernatant liquor from settled sludge gives low results (not subject to empirical correction) due to the high oxygen demand of the sludge itself. However, the writer believes that with proper care it is entirely permissible (for routine plant control) to work on a supernatant liquor and thus avoid the complications of sludge floc or the use of special equipment. It is always desirable to have a margin of safety in plant operation and the errors pointed out by Theriault and McNamee are on the side of safety.

At Salinas we collected samples of mixed liquor from various points throughout the aerators in 2 liter bottles. The bottles were completely filled, stoppered and al-

*With Chas. A. Haskins, Consulting Engineer, Kansas City, Mo.

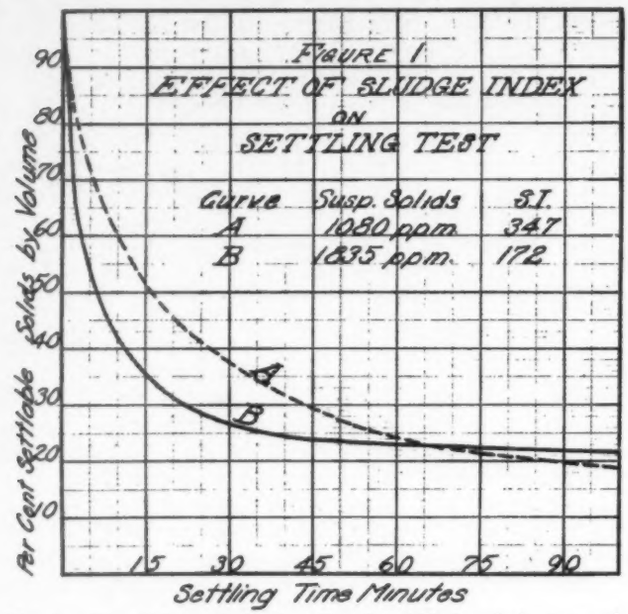


Fig. 1.—The Effect of Sludge Density (Sludge Index) on the Volumetric Sludge Settling Test.

lowed to stand until 270 m.l. of fairly clear supernatant liquor could be siphoned off into small bottles. The permanganate modification of the Winkler method was then used to determine the dissolved oxygen content of these smaller samples. Ordinarily 5 to 15 minutes' standing of the 2 liter samples would result in sufficient clarification although at times of severe bulking as much as 40 minutes elapsed before the small samples could be siphoned off. On several occasions we siphoned off a second small sample an hour or two after taking the first one and repeated the D.O. determinations. The decrease in dissolved oxygen in the supernatant over the elapsed time was surprisingly small even though the liquor had been underlain by sludge all that time.

Second Operating Requirement

The necessity of maintaining an adequate supply of dissolved oxygen in the aerators at all times, when coupled with the desirability of keeping the power expenditure for aeration at a minimum, leads directly to the second operating requirement—namely, that of keeping the oxygen demand of the mixed liquor at a minimum. The oxygen demand of the mixed liquor is in part due to that of the sewage and in part due to that of the sludge. However, that of the sludge is so much the greater, that of the sewage becomes almost negligible. Grant, Hurwitz and Mohlman[8] proved in the laboratory that (a) mixtures of sewage plus sludge absorb oxygen in proportion to the weight of sludge but with increasing amounts of sludge most of the oxygen demanding material of the sewage is coagulated or adsorbed by the sludge so that very little oxygen is required for the unadsorbed material, and (b) small amounts of sludge reduce the B.O.D. of the sewage almost as rapidly as do larger amounts. Their findings have since been proven in many full scale plants.

It is, therefore, the problem of the operator to first determine the minimum *weight* of sludge that it is necessary to carry in his own individual plant and then, second, to so control the rate of sludge return that that minimum amount is never greatly exceeded. To solve that problem it would be desirable to have some rapid and accurate means of approximating the *weight* of solids in a given volume of mixed liquor or return activated sludge. As yet no universally satisfactory method of making this determination has been devised. Three methods that have been more or less generally used are (a) settling tests, (b) suspended solids determinations, and (c) centrifugal tests.

All have their disadvantages.

Settling Tests

These are the simplest tests and were the earliest tests used. Samples of sludge or mixed liquor are simply collected in liter graduates, allowed to stand for some given time, and the per cent of settleable solids observed at the end of the given time. In the early days it was usually customary to carry about 20 per cent sludge, after 30 minutes standing, in the mixed liquor. The test is still used and is quite helpful so long as its limitations are kept in mind. Various standing times are used ranging from 10 minutes to 1 hour.

Attempts to correlate the volume of settleable solids, as determined in this way, with the actual weight of the suspended solids in the sample soon showed that no such relationship existed unless the sludge index[9] was also taken into consideration, see Figure 2. "The sludge index (S.I.) is the volume in cubic centimeters occupied by 1 gram of sludge solids after settling 30 minutes." The longer the settling test samples are allowed to stand, i.e., the more the sludge compacts, the less the influence of the S.I. on the results of the test and hence the closer their approximation to the actual weight of sludge solids present. Figure 1 illustrates this point fairly well. However, the rate of sewage inflow to the aeration tanks is constantly changing and tests to regulate the amount of return sludge must be rapid if the weight of sludge solids returned is to be varied in accordance with the sewage flow.

In general the settling test alone can not be relied on except in the smallest plants, and even then only in those small plants that are so amply designed that they are subject to little bulking. In such plants the possible saving in power may not be great enough to warrant the added cost of conducting more accurate test methods.

Suspended Solids Determinations

Suspended solids determinations are the only accurate

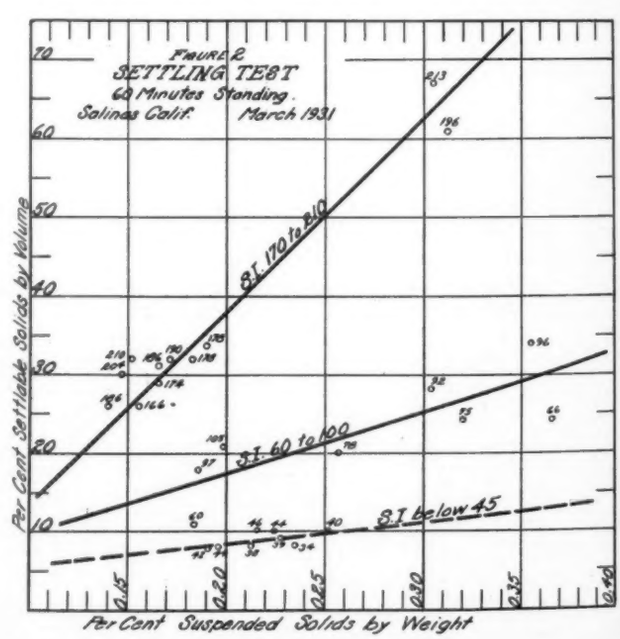


Fig. 2.—A Picture of the Lack of Correlation Between Volumetric Sludge Test and the Gravimetric Test. The Necessity of Taking into Consideration the Density and Settleability (Sludge Index) Is Clearly Evident.

means of determining the actual *weight* of sludge solids in a given sample of mixed liquor or return sludge. Unfortunately so much time is required for making the determinations that the test is useless as a means of coordinating the hourly rates of addition of sludge solids with the hourly rates of sewage inflow to the aerators. In spite of this handicap the test is extremely valuable and should be made at least once a day at all but the very smallest plants. It should be made at the same time each day; the time selected should be such that the sewage flow for the past several hours has been nearly identical with that of the same hours of each preceding day.

For example, at Salinas[5] we took samples for suspended solids determinations each day at 9 a. m., there being only slight day to day variations in the hourly rates of flow received at that plant between 2 a. m. and 9 a. m. We governed the daily amount of activated sludge wasted almost entirely by the results of these determinations. (The rate of sludge withdrawal from the clarifiers was governed by hourly determinations of the depth of sludge in them. We attempted to keep the rate of withdrawal as low as possible without permitting more than a 1-foot depth of sludge at the sides of the Dorr tanks.) This procedure did *not* accomplish the very desirable end of keeping the suspended solid content of the aerators constant at all times throughout the day. It was probably at a minimum about 11 a. m. when the peak flow started coming in and at a maximum between 10 and 11 p. m. when the flow started dropping off rapidly. However, it did serve to keep the *average daily* suspended solid content of the aerators fairly constant.

Before leaving the subject of gravimetric solids determinations the writer wishes to make a plea for all operators to base their control on *suspended* solids determinations rather than on *total* solids determinations. It is the suspended solids in the sludge that exert the bulk of its oxygen demand. It would be permissible to base plant control on total solids determinations only if the dissolved solids were practically constant. Such is not the case—at Salinas,[5] dissolved solids in the mixed liquor, and plant effluent, ranged from 600 to 1500 p.p.m. under varying sludge conditions.

Centrifugal Tests

This test consists of collecting samples of mixed liquor or sludge in 15 m.l. centrifuge tubes and "spining" them for a given short time (2 to 5 minutes) in an electrical centrifuge. A hand centrifuge will not serve because of the impossibility of always spining the samples at the same speed. The writer first heard of this test being used at the Indianapolis plant some eight or nine years ago. We tried it for several months at Salinas. Mr. Anderson[2, 3, 4] has recently reported its successful use at Rockville Center. The test has probably been used at several other plants but it has never been widely adopted. To the writer's knowledge, Mr. Anderson is the first to mention it in the literature.

Like the settling test, the centrifugal test is at best volumetric determination. Nevertheless, it has two outstanding advantages over the gravity settling test. (a) It is extremely rapid and so may be utilized, with reservations, to control the hourly rates of sludge withdrawal or return. (b) It compacts the suspended solids more and hence there is better correlation between its results and those of gravimetric suspended solids determinations. However, even the results of this test are greatly influenced by the sludge index as is clearly shown by Figure 3. If that fact is not fully appreciated the operator may encounter serious complications in attempts to regulate *weight* of suspended solids in his aerators.

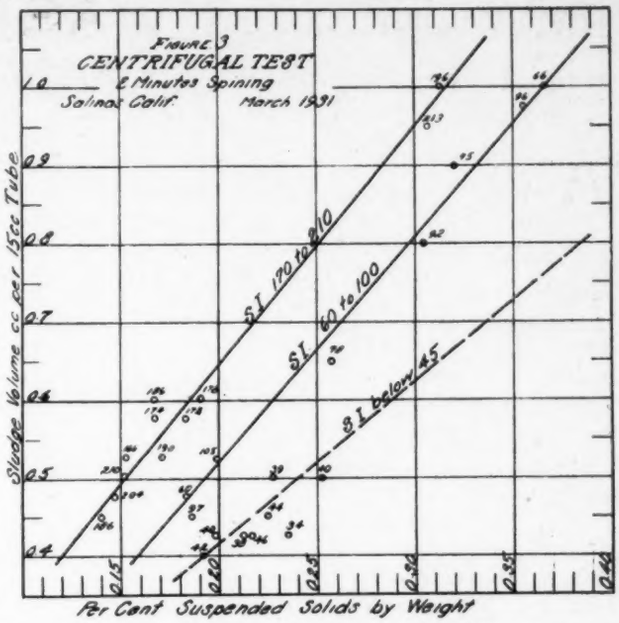


Fig. 3.—A Picture of the Less but Evident Effect of Sludge Index Values on Suspended Solids Tests With the Centrifuge

If the test is to be used the operator should first make sufficient trials to prepare a graph similar to Figure 3. Once such a graph is available he may determine the sludge index once a day and from that determination and the graph he can select the desirable centrifugal test results for the more frequent determinations made on the mixed liquor, return sludge, etc.

To substantiate this assumption we submit Table I. Sample 6 was a sample of the return sludge from the Salinas plant; samples 1 to 5, inclusive, were prepared by diluting sample 6 with varying amounts of final effluent that had been collected at the same time.

TABLE I

Sample	Suspended Solids % by weight "A"	Settleable Solids % by volume 30 min. standing "B"	Sludge Index (B/A)
1	0.064	5	78.1
2	0.172	15	87.2
3	0.289	25	87.2
4	0.400	35	87.5
5	0.549	50	91.1
6	1.078	100	92.8

REFERENCES

(1) F. W. Harris, T. Cockburn and T. Anderson, "Biological and Physical Properties of Activated Sludge."—Water Works, 66, 24 (January, 1927).
(2) C. George Anderson, "Operating Activated Sludge Plant to Prevent Sludge Bulking."—Water Works & Sewerage, 83, 342 (September, 1936).
(3) C. George Anderson, "Running an Activated Sludge Plant on D.O. Determinations."—Water Works & Sewerage, 83, 418 (November, 1936).
(4) C. George Anderson, "Activated Sludge Control at Rockville Center and the Prevention of Bulking."—Sewage Works Jour., 8, 784 (September, 1936).
(5) T. R. Haseltine, "The Activated Sludge Process at Salinas, California, with Particular Reference to Causes and Control of Bulking."—Sewage Works Jour., 4, 461 (May, 1932).
(6) "Standard Methods of Sewage Analysis."—Sewage Works Jour., 7, 459 (May, 1935).
(7) Emery J. Theriault and Paul D. McNamee, "Apparatus for the Determination of Dissolved Oxygen in Sewage Sludge Mixtures."—Sewage Works Jour., 6, 413 (May, 1934).
(8) S. Grant, E. Hurwitz and F. W. Mohlman, "The Oxygen Requirement of the Activated Sludge Process."—Sewage Works Jour., 2, 238 (April, 1932).
(9) F. W. Mohlman, "The Sludge Index."—Sewage Works Jour., 6, 119 (January, 1934).

NEW JERSEY SEWAGE WORKS ASSOCIATION HOLDS 22ND ANNUAL MEETING

AT TRENTON, N. J., on March 11th and 12th, America's oldest sewage works association held its 22nd annual meeting with an attendance of 250 or better, and 210 actual registrations.

P. N. Daniels, long and favorably known for having introduced the "Speechless Dinner," was again in charge of meeting arrangements and master of ceremonies at what was conceded the best attended and least "hazardous" dinner for some years past. The quartet was good—what's more, could be heard.

Ed. Molitor Successful Pinguesser

At the dinner, Ed. Molitor was announced winner of a $25 prize.

Wallace and Tiernan Company had an exhibit of unique nature. A map of New Jersey, pin-studded with W. & T. chlorinator installations gave all comers a chance to guess the total number and drop the stub in the box. Nearest guesser to the correct number (402 pins) was Association Vice-President, Edward P. Molitor, Supt. of Chatham's Treatment Works.

Business Meeting

Following a report of Treasurer Paul Molitor, Jr., on the healthy financial condition of the association, even after having purchased the new and much needed public speaking amplifier system, he reported a substantial gain in advertising in the association's Proceedings and again urged members to "remember our supporting advertisers and those who exhibit at our meetings."

Then came forth a resolution, heard in previous years, to change the meeting place from Trenton to Atlantic City. Following discussion it was moved and voted to have a committee named to study and report to the Executive Committee on meeting places, and the taking of action before the 1938 meeting.

As is the custom, association officers carry over for two consecutive terms and are the same for 1937 as for 1936—namely:

President—*Edward P. Hyland, Supt. Water and Sewerage, Moorestown.

Vice-Pres.—*Edward P. Molitor, Supt. of Sewerage, Chatham.

Vice-Pres.—Samuel R. Probasco, City Engr., Burlington.

Secretary—John R. Downes, Supt. Treatment Works, Plainfield.

Edward P. Hyland, Supt. Water and Sewage, Moorestown, N. J. (President of the Association).

P. N. Daniels, Supt., Trenton Treatment Works, Veteran Wheel-Horse. In charge of Meetings Arrangements.

Brass Hats

1st Vice Pres., Edw. P. Molitor, Plant Supt., Chatham; Secy., John R. Downes, Plant Supt., Plainfield; 2nd Vice Pres., Samuel R. Probasco, City Engr., Burlington.

Treasurer—Paul Molitor, Jr., Supt. Sewerage, Morristown.

*(Must be something to these Edwards—This time its "Edward P.'s"—Ed.)

Exhibits

In number and quality surpassing previous years, exhibits were staged by the following 24 manufacturers:

American Brass Company	Link Belt Co.
Chain Belt Co.	Lord & Burnham Co.
Chicago Pump Co.	N. J. Laboratory Supply Co.
Carter, Ralph B., Co.	Pacific Flush Tank Co.
Dorr Company	Penna. Salt Mfg. Co.
Eimer & Amend	Proportioneers, Inc.
Fairbanks, Morse & Co.	Solvay Sales Co.
Flexible Sewer Rod Co.	Taylor, W. A., Co.
Gurley, W. & L. E.	Thomas, A. H., Co.
Hardinge Co.	Turbine Sewer Mach. Co.
Inertol Co.	Wailes, Dove-Hermiston Corp.
Kingston Trap Rock Co.	Wallace & Tiernan Co.

Technical Sessions

(Edward P. Hyland, Presiding)

"PWA and New Sewage Treatment Works"—By C. E. VELZ, Acting State PWA Engineer, Trenton, N. J.

To many, Mr. Velz's paper revealed an astounding extent of progress which has been made in sewerage betterments and treatment plant construction in New Jersey since the advent of Public Works Administration assistance. In all, the 37 projects reported on involved an $8,500,000 expenditure for sewerage betterments of a major nature. The policy followed had been that of determining the degree of treatment required for a given river, as a whole, in order to insure a minimum dissolved oxygen content amounting to 30 per cent of saturation. Supported by State Health Department actions the program involved a mandatory requirement that all communities on the water-shed area provide the minimum treatment required. PWA financing had made the program attractive to municipalities.

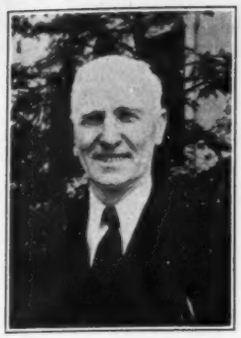
In the case of the important Raritan River Project, a 65 per cent sewage load reduction had been decreed, with every community in the Raritan Valley individually providing the degree of treatment required to meet local requirements. Completed or under construction in the Raritan Valley project alone were the following plants:

Raritan: Chemical precipitation, mechanical effluent filters, chlorination, vacuum filtration of sludge and incineration.

Somerville: Chemical precipitation, mechanical effluent filters, chlorination, vacuum filtration of sludge, land disposal.

Manville: Sedimentation, trickling filter, sludge digestion, sand beds.

Bound Brook: Chemical precipitation, chlorination, separate sludge digestion, sand beds, garbage incinerator.



Left—Paul Molitor, Sr., Chatham, N. J., Dean of N. J. Operators; Founders and Past-President of the Association. Right—Asher Atkinson, City Engineer; New Brunswick is proud of his new Chemical Treatment Plant and low cost.

Middlesex: Chemical precipitation, chlorination, separate sludge digestion, glass covered sand beds.

Plainfield (Joint Plant): Enlargement of plant, involving chemical precipitation ahead of trickling filters, improved sludge digestion facilities and dewatering by "spray-drying."

Metuchen: Existing trickling filter plant rebuilt.

New Brunswick: Chemical precipitation, chlorination, separate sludge digestion, vacuum sludge filters and land disposal.

Highland Park: Sedimentation, chlorination, separate digestion, glass covered beds.

Sayerville: Chemical precipitation, mechanical effluent filtration, vacuum sludge filter.

Somerville: Chemical precipitation, mechanical effluent filtration, vacuum sludge filter.

Keyport: Sedimentation, chlorination, separate sludge digestion.

Perth Amboy (the first to be completed): Chemical precipitation, mechanical effluent filtration, chlorination, vacuum sludge filters, sludge-cake to dump.

In addition, the Elizabeth Valley joint plant and system, which had with PWA aid been brought to completion, involves sedimentation, chlorination and barging sludge to sea. And the Rahway River Valley system and joint plant of 12.5 M.G.D. capacity, to serve all communities in the valley, would also be in operation early this year. The latter plant provides sedimentation, chlorination, separate digestion of sludge.

Chemical Precipitation Studied

"Operating Results of the Perth Amboy Plant"—By S. KOWALCHIK and H. GREENFIELD, Assistant Engineers, N. J. State Department of Health, Trenton, N. J.

Presented by the senior author, this paper constituted a presentation of operating results at the Perth Amboy chemical precipitation plant during a summer performance investigation, made by the N. J. Department of Health. Briefly describing the plant, which was the first of the modern chemical plants in the state, and listing the chemicals involved as ferric-chloride, lime and chlorine (all automatically controlled), Mr. Kowalchik said that the sludge, conditioned with ferric chloride and lime, is dewatered on vacuum filters and carted to a dump without nuisance resulting. Features of the plant involved the effective Laughlin magnetite effluent strainers set within the radial flow circular clarifiers. Detrimental to operation were the extremes in flow fluctuations, due to booster pumping and variable quality of industrial waste impregnated sewage. At times the sewage was essentially slugs of industrial wastes, with reaction varying from highly acidic (pH 4.8) to highly alkaline (pH 9.2). B.O.D. values ran from 250 to 2,260; suspended solids 40 to 6,220; b. coli from 5,000 per c.c. to sterility.

Without chemicals added, an average reduction of 75 to 78 per cent B.O.D. and 65 to 75 per cent suspended solids, proved to be the net performance of the clarifiers and the shallow Laughlin straining filters. The use of chemicals and one hour of clarifier detention yielded 84 per cent B.O.D. reduction and 94 per cent suspended solids removal. Within two hours detention (two clarifiers and filters in service) these removals increased to the surprising result—92 and 96 per cent, respectively. Most impressive was the uniformity of B.O.D. value and suspended solids content of the effluent, notwithstanding the extreme variations in flow and quality of sewage dealt with. Such was, inescapably, indicative of the effectiveness of the magnetite straining units in taking care of high flows and deficient or imperfect precipitation which was unavoidable at times.

Graphically, purification was compared with performance of New Jersey trickling filter plants, and the investigation had revealed a wholly satisfactory result from the chemical precipitation process. Expectations, upon which the process was approved for the drastic conditions at Perth Amboy, had been met. From the charts and figures showing the short sedimentation periods supplemented by mechanical effluent straining, proved equal or better than the most efficient longer period sedimentation plant performances. With the aid of chemicals, a result more nearly approaching sprinkling filter performance, than plain settling performance, would seem to be the order of evaluation.

"Improvements at the Plainfield Plant"—By JOHN R. DOWNES, Supervising Engineer, Plainfield Joint Treatment Works, Bound Brook, N. J.

Mr. Downes, with the aid of moving pictures, traced recent improvements at the Plainfield plant, involving partial chemical precipitation ahead of long servicing and overloaded existing trickling filters; additional sludge digesters; conversion of the original Imhoff tanks to plain settling tanks, and more recently to mechanically cleaned units; introduction of spray-drying of sludge and recent improvements to the spray-drying plant. The latter incorporated improved sludge concentrating vats, involving water separation by chemical treatment and decantation; permanent tile-lined cyclone dust separator and exhaust stack of corrosion resistant "Transite." In chemical precipitation "chlorinated-copperas" had replaced earlier coagulants and flocculation had been improved materially with a rapid primary mixing, with diffused air, followed by the rotating flocculating paddles.

Pollution Control—Pro and Con

Two able speakers presented their views on the topic **"How Best to Control Stream Pollution."**

HARRY E. JORDAN, Executive Secretary of the American Water Works Association, discussed the broad and basic aspects of future methods of relieving pollution

The "Old Guard"

"Ed" Schissler, Supt. Haddon Heights; Past-President of the Association. "Chet" Wigley, Consulting Engineer, Atlantic City. (Was Chief Engr. N. J. Dept. Health and a Founder of the Association.) I. R. Riker, Supervising Engineer, Princeton Sewage Works.

loadings on water-ways. In this he pointed out the essential inter-relations between water usage, land usage and pollution tolerances. This involved the question of storage reservoirs on head waters, to provide regulated dilution and preclude low water-high pollution river stages; and, land coverage control for ground storage betterment. He discussed briefly the fallacy of proposed Federal control of streams to secure pollution abatement with its attendant weaknesses, needless interference with state and local authorities, and costliness. He cited resolutions drawn by leading water works associations, societies of civil engineers and sewage works associations, which recommended a central Federal pollution authority for the purpose of conducting studies and basic research and seeking coordination efforts of various pollution authorities; assisting state or local authorities upon request, but otherwise leaving the actual prosecution of pollution abatement in the hands of state authorities and local rivers boards. Patterned on this general policy and plan had been the Barkley-Vinson Bill now before congressional committee for hearings, preparatory to action.

"Water Pollution—A Problem of National Emergency"—By PHILIP G. PLATT, National Director, Isaac Walton League, and Member of the Pennsylvania Water Board.

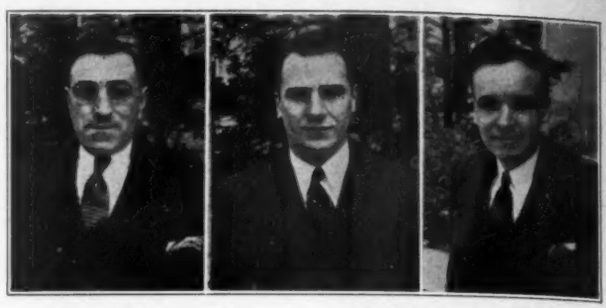
As if in answer to Mr. Jordan, Mr. Platt sought to show that Federal control was needed to accomplish something worth while, because established systems of pollution control in the hands of States had failed miserably in so far as accomplishments could be cited as evidence. That the situation might be corrected, Senate Bill No. 13 had been drawn by Senator Lonergan of Connecticut. Strange bed fellows had joined, however, to defeat the Lonergan Bill. Amongst these were A.W.W.A., burocrats and chambers of commerce. To the latter two groups the Barkley-Vinson Bill appealed, because it would hurt nobody and provide $700,000 annually to States and $300,000 annually to the U. S. Health Service for a period of 10 years.

Drastically, Mr. Platt charged as being stumbling blocks to better stream conditions (1) public apathy; (2) state health departments which had successfully sidestepped the industrial waste problem, some being dictated to by industry; (3) industry's lack of effort or interest in the matter of evolving waste treatment. He thought that the time had come when the hiring of "Investigation Engineers" and the drafting and filing of "Reports" and "Recommendations" should be superceded by less of both, and more of genuine action. In this direction the Lonergan Senate Bill 13 enjoyed the backing of conservationists, but suffered blockage by bureaucrats, polluters, investigationists.

MR. HESS, recently made Chief Engineer of the Inter-

S. Kowalchik, Asst. Engr., N. J. Dept. of Health.

R. S. Ingols, Asst., N. J. Experimental Station.



P. D. Brandenberger, Supt., Sewer Maintenance, Atlantic City; A. S. Gehm, Asst., N. J. Experimental Station, New Brunswick; J. Bernard Baty, Engr., Pennsylvania Salt Co., Philadelphia. (When snapped, Mr. Baty was still with N. J. Dept. of Health.)

state Sanitary Commission (N. J. and N. Y.), by way of a reply to Mr. Platt's views, remarked that pollution problems were not susceptable to methods of wholesale handling. Admittedly most state health engineers had been powerless to deal alone with nuisances, not necessarily health menaces, but progress was being made. Interstate problems had proved the most perplexing, and the N. J.-N. Y.- Sanitary Commission had been legally set up to not alone investigate, but also to correct. At the same time there was coordination with the authorities of each state.

WESTON GAVETT, New York Consulting Engineer, with due credit to Isaac Walton League influence, directed attention to what had been accomplished through Federal assistance rather than Federal force in New Jersey during the past two years in the matter of pollution abatement. It was a fact that industry was doing more in this direction also and cooperation was advancing.

Joseph LeChard, Chief Engr., Atlantic City Sewerage Co. "The customer is always right."

Wilder M. Rich, City Mgr., Hackensack, N.J., planning a treatment plant and swimming in the Hackensack.

Other discussors of Mr. Platt's paper were Arthur Shaw (Boston) and L. H. Enslow (New York).

"Work of the New Jersey Sewage Experiment Station"—By DR. W. RUDOLFS, Director of the Station, New Brunswick, N. J.

In his annual review of experimental work conducted at the N. J. Sewage Experiment Station, Dr. Rudolfs touched on only the principal studies. Such involved the important clarification (bio-stabilization) stage of the activated sludge process; chemical precipitation of municipal and industrial sewages; effect of garbage and trade wastes on sewage treatment processes.

In the activated sludge studies it had been shown that a well oxidized sludge quickly and effectively clarifies, the ratio of weight of sludge returned to suspended matter in the sewage being the all important factor in producing maximum results. In this stage biological action

Consultants—Three

John Boardman, Cons. Engr., Philadelphia, Pa. Elson T. Killam, Cons. Engr., New York City. Arthur Shaw of Metcalf and Eddy, Boston, Mass.

played a minor role, later the carbonaceous matter becomes oxidized and finally the nitrogenous. In studying mixing, air agitation produced the most rapid results whereas the use of nitrogen was detrimental, and mechanical mixing was intermediate.

In the chemical precipitation studies by Mr. Gehm, it had been shown that most effective results attended short rapid initial mixing, followed by flocculation (slow stirring effect) for 15 minutes. The return of sludge floc proved of value in reducing coagulant by 25 to 125 lbs. per m.g. The returned sludge and coagulant should, however, be added very close together, with the sludge slightly ahead.

In studying the effect of industrial wastes on sludge digestion, tannery wastes in the sewage up to 20 per cent by volume had no ill effects—upper limits being 30 to 40 per cent. Oils did not prove detrimental whereas as little as 1 per cent by volume of gasoline upset digestion. High temperature digestion proved helpful in some instances but the opposite in others. Best results came from a 4-day primary period of high temperature followed by normal temperature.

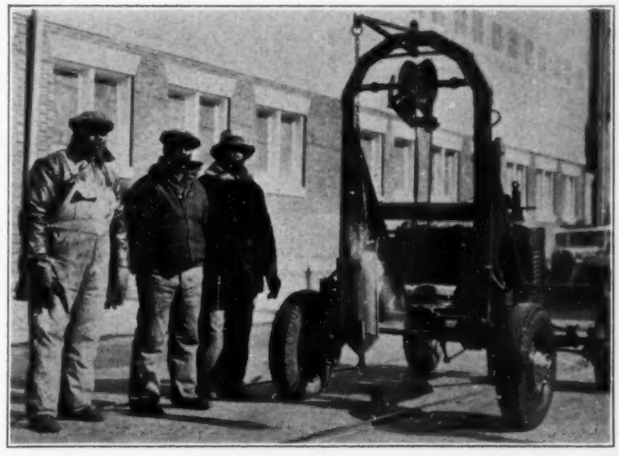
As to the interesting study of garbage effects Dr. Rudolfs preferred to let Mr. Ingols tell his story later in the meeting.

Sewer Maintenance and Cleaning

"Maintenance and Cleaning of Atlantic City's Collecting System"—By JOSEPH H. LECHARD, Engr., Atlantic City Sewerage Company, Atlantic City, N. J.

Aided by lantern slides and moving pictures, Mr. LeChard presented an illuminating discussion of cleaning and maintenance methods and equipment utilized by one of America's few and best known sewerage utility companies. Dating back to 1884, Atlantic City Sewerage Co. was now operating 82 miles of sewers, 6 miles of which is of cast iron pipe from 10 to 36 inch diameter, the laterals vitrified clay and trunk lines of reinforced concrete pipe. Unique in design, with rather flat grades, most of the laterals and trunk lines have been cross-connected for precluding flooding by automatically changed sewage routing, in case of stoppages. Ninety (90) per cent of the sewers lay in ground water and required especially tight joints to preclude surcharging and reduce pumping costs. About 93 per cent of the 12.5 M.G.D. average flow (9 min. 18 max.) required pump lift to three treatment works serving as many separate systems.

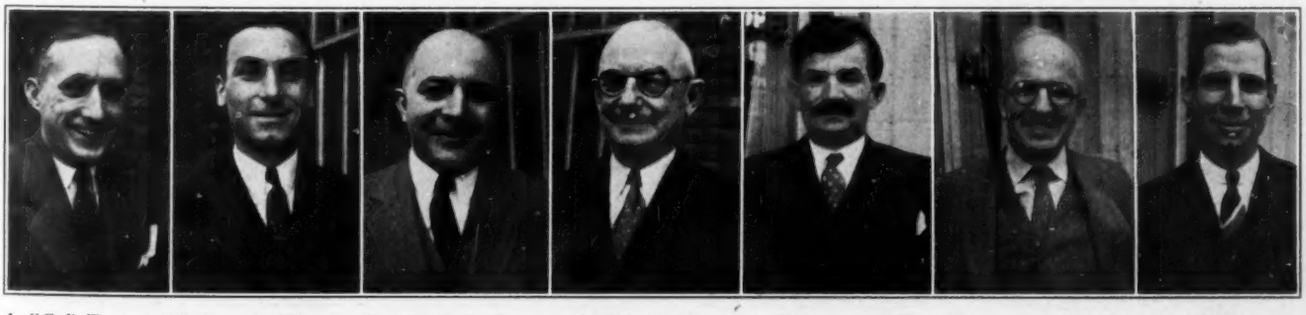
In operating such a system Mr. LeChard said that maintaining tight and clean sewers was the most essential consideration and $25,000 annually was being spent on such work. Routine cleaning was divided between two groups having a different type of operation to perform on scheduled routings. One group handled the street sewers and operated 6 days each week (see photo), the other being charged primarily with cleaning of individual house service lines from lateral to the house service traps (a stopping place for false teeth and jewelry) at the curb line. The latter service operated 24 hours daily and handled complaints within 30 minutes of call.



Atlantic City Sewer Co.'s pride and joy. The Champion and its Buck Crew, at work 6 days every week cleaning sewers.

A standing agreement with the Master Plumbers Association precluded giving of service on private property. Much time of the emergency call crew had to be devoted to odor complaints, traced to another source than the sewer in most instances. Tools and equipment are carried on a light delivery truck, the most useful device for removing ordinary stoppages being a 50 ft. length of ¼ inch steel wire with a right angle bend at the end inserted. With hand or wrench cranking action on the wire the spiral motion imparted to the wire and tooth-end did the job.

The gang handling the street sewers previously consisted of five men operating hand power cleaning equipment, until the recent purchase of O.K. Champion



1. "Cy" Tygert, Wallace & Tiernan Co.; 2. L. J. Fonterreli, Chief Operator, Rahway Valley Treatment Works; 3. Norman C. Wittwer, Super. Engr., Rahway Valley Sewage System; 4. Wm. H. Graham, Supt., Verona, N. J.; 5. John Mick, Chief Operator, Essex Falls, N. J.; 6. Jos. P. Breeze, Boro. Clerk, Hasbrouck Heights, N. J.; 7. "Bart" Marshall, Mgr., Sanitary Division, Chain Belt Company, Milwaukee.

1. J. L. Radcliffe, Chem., Elizabeth (N. J.) Water Co.; 2. F. E. Whithead, Health Exec., Oradell, N. J.; 3. J. K. Adams, Supt., Tenafly, N. J.; 4. C. D. Turner, Engr., Wailes Dove Hermiston Corp.; 5. Lester Barnard, Supt., West Caldwell, N. J.; 6. H. R. Allen, Boro. Engr., Woodridge, N. J.; 7. Bob Mannheim, Mathieson Alkali Works, New York City.

Sewer Cleaners. The first unit, purchased for $1,800, had paid for itself during the first year of operation, its use resulting in speedier more effective work with two less men. Atlantic City's cleaning costs had been reduced, thereby, for 13 cts. per foot (average) to 7 cts. per foot; and, but for considerable night work would have been even lower. Mr. LeChard then described the method of setting up and operating the Champion Sewer Cleaners with a crew of three men. He explained its several interesting labor saving and safety features, amongst which were the automatic power release, and the "free-wheeling" clutch which reduces power load on the 5 H.P. gasoline engine, and saves wear and tear.

Chief amongst contributing causes of stoppage, was a combination of sheer waste of valuable grease from the many hotels, and sand from bathers taking showers. Aside from choking sewers, balls of grease, match sticks, et al accumulate in manholes. Responsible for other stoppages an amazing exhibit of articles removed from sewers was shown on the screen.

In maintenance, the cleaning crews make careful inspections and report needed repairs, patching or painting of metal parts. The larger sewers are inspected by travel through them, and the concrete sewers had been found to hold up very well. Amongst other varied duties, the sewer gang had been used by Federal agents in tracing down illicit stills by following the course of spent mash up sewers.

"Proposed Method of Sewage Disposal and Development of the Hackensack River for Recreational Purposes"—By W. M. RICH, City Manager, Hackensack, N. J.

Under mandate from the State Department of Health to abate pollution, Mr. Rich told of proposed plans by Hackensack, N. J., to construct a central activated sludge plant of 4.5 M.G.D. capacity and the requisite intercepting sewer to the plant site. The problem of handling storm flows had not been satisfactorily answered, but the only solution seemed to be storm flow tanks and chlorination of the by-passed flows. The average dry weather flow through the combined sewers was but 2.4 M.G.D. whereas the proposed plant would handle up to 4.5 M.G.D. The proposal, now made, involved the construction of a dam on the Hackensack and thus create a recreation park, after taking the sewage out of the river, and plans were to be put through with WPA assistance as early as possible.

"The Effect of Added Garbage on Sewage Purification by Sedimentation"—By R. S. INGOLS, N. J. Sewage Exptl. Station, New Brunswick, N. J.

In order to determine the results of adding finely ground garbage to sewage, Mr. Ingols studied the effects of varying ratios of garbage solids added to sewages from different sources and of varying ages. Garbage in amounts equal to one and a half times and twice the solids in the sewages was added. Observations in laboratory tests in Imhoff cones indicated that the greater the garbage ratio the more rapid was the settling out of the whole of the settleable solids. In other words the clarification effect was enhanced in the early stages of sedimentation, by addition of garbage solids. This reflected what might be expected in grit chambers in the way of increased putrescibles in the grit. Although denser, a more rapid souring of the sewage-garbage sludge was noted than of the sewage sludge, indicating need for prompt removal from settling units.

As to the effect of garbage additions on the clarified sewage (supernatant) Mr. Ingols pointed to the fact that there had been conflicting reports in the literature and the reason had appeared later in his studies, involving three different sewages. In one case added garbage solids, anywhere between 50 per cent and 200 per cent of the sewage solids reduced the residual suspended solids from 106 parts in the settled sewage to between 88 and 92 in the garbage treated portions. In another instance, 84 parts in the settled sewage compared with an increase of 94 to 98 in the settled mixture. In another, the 50 per cent garbage addition created little difference (136 vs. 138 parts), but the larger quantities left suspended solids of 190, 204, 234 parts in the supernatant, with even more marked increases in oxygen demand values.

1. John T. Rogers, Supt., Woodridge, N. J.; 2. Dr. A. J. Fischer, Dorr Company; 3. Fred Eayers, Supt., Highland Park, N. J.; 4. Millard Van Dien, City Engr.-Mgr., Essex Falls, N. J.; 5. W. A. Darby, Engr., Dorr Company, New York City; 6 L. L. Langford, Engr., Pacific Flush Tank Company, New York City; 7. Louis C. Milani, Supt., Hasbrouck Heights, N. J.

To further test the behavior of different sewages the identical ground garbage was added to the three different sewages with the following picture resulting:

Sewage	Highland Park Susp. Sol.	Highland Park B.O.D.	New Brunswick Susp. Sol.	New Brunswick B.O.D.	Plainfield Susp. Sol.	Plainfield B.O.D.
Raw	216	233	246	210	354	440
Settled Sewage..	60	110	158	135	124	180
Settled Mixture.	86	140	82	165	126	230

Said, Mr. Ingols, the picture gives one but little assurance that he can predict the effects of added garbage or the quality of the settled sewage resulting, and explains conflicting reports in the literature. In respect to the effect on B.O.D. values there was less variation, as noted in the above results. In two cases the net garbage contribution was an additional 30 parts and in the stronger sewage 50 parts. From this there must be assumed that some interaction between the sewage and garbage, not capable of prediction, may cause a higher or lower solids content of the settled sewage; but, will always produce an increasing oxygen demand value the extent of which is considerably higher with some sewages than with others.

The Question Box

Dr. Rudolfs was called upon for an answer to the questions "What is the argument for garbage in sewers?"; "What comparative cost to the householder?"; "What will taxpayers say when the sewage plant must be enlarged?" He regretted that Mr. Cohn or someone else interested in garbage grinding and disposal by sewers was not present. The "G.E." household grinders cost between $150 and $160 and many he thought would be sold. The average man would have to be prepared. This meant the possibility of doubling digestion tank capacities and adding 30 to 50 per cent biological oxidation capacity.

CAPTAIN PAUL MOLITOR, veteran operator and a founder of the association, said that he considered garbage incineration the more practical solution but believed that the sewage works and garbage incinerator might well be under one head on the same or adjoining grounds.

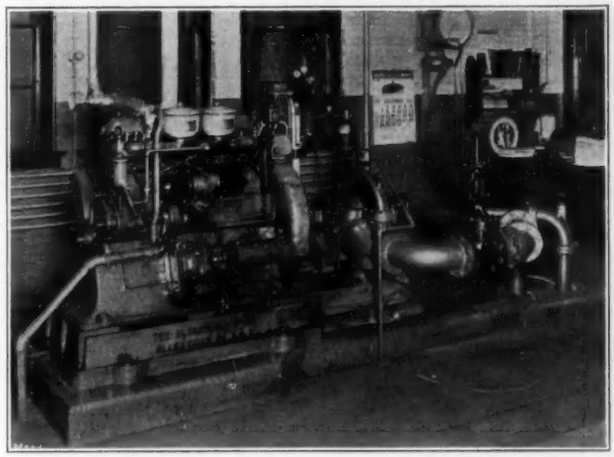
ASHER ATKINSON, City Engr., of New Brunswick, voiced an objection to garbage to sewers in view of complicating sewage treatment, without eliminating the garbage and rubbish collection operations which must go on just the same.

LINN H. ENSLOW said that he thought there was much to the point in Captain Molitor's remarks and reported on the fine demonstration of power production from garbage and rubbish burning at Providence, R. I., where the incinerator was next door to the activated sludge plant and supplied more than the requisite power to operate the plant and pump all of Providence's sewage. Both plants as well as the water works had been constructed and operated under one general head—the Director of Public Works. At the same time where power was to be generated from digester gas at sewage works, the introduction of some garbage to sewers had been shown to be of value in boosting the gas and making it possible to operate on digester gas alone and have a surplus of power which might be carried to the capacity of the engines or that of the treatment process involved. It began to appear that combustion and power engineering were to become highly important considerations in the practical economies of municipal wastes disposal in the future. The questions were becoming more involved, the solutions less stereotyped and real engineering more essential as time went on.

First Automatic Diesel Pumping Station Completes Full Year's Operation

The municipal pumping station of the North Easton, Mass., water works system has recently completed its first full year of operation with power supplied entirely by Diesel engines. This station is, so far as we are aware, the first in the country to have a fully automatic, Diesel driven centrifugal pump.

The results of the first year's operation have proved the complete satisfaction of Diesel power for automatic pumping station operation. According to reports, the Diesel has required but minor maintenance expenditure, while operating over a period of more than 1800 hours and automatically starting and stopping six to eight times



North Easton's Fully Automatic Diesel Powered Pump Station

daily. With fuel oil cost at 5½c per gallon, the new engine has operated at a cost which would have required a rate for electric power of less than ½c per K.W. hour —a figure hard to beat.

The successful automatic feature of the plant denotes another forward stride in Diesel service for water pumping. Having released an engineer for other duties, a considerable savings in operating costs has been effected thereby.

The North Easton installation not only maintains automatically the desired pressure on the system, but supplies as a by-product all the heat required to maintain the pumping station temperature at 70 degrees.

For the above information we are indebted to Mr. George B. Bailey of The Thermal Engineering Company of Boston, Mass., who made this installation. It consists of a 600 G.P.M. Aldrich Centrifugal Pump direct connected to a six-cylinder 4⅜ x 5¼ in. Hercules Diesel Engine, operating at 1400 R.P.M.

▼

Buffalo to Have Combination Digestion and Sludge Incineration

Greeley and Hansen, of Chicago, who are serving as engineers on the $15,000,000 sewerage and sewage treatment project for Buffalo, N. Y., announce that the main treatment works (to be located on Bird Island), will provide partial digestion of sludge, mechanical dewatering and incineration. The plant cost will be $3,800,000. For overall economy and flexibility of operations, careful analytical studies revealed sludge disposal by partial digestion followed by incineration to be the best procedure. The digester gas will be run through storage gas-holders for use in the sludge cake incineration process.

Water Works and Sewerage—April, 1937

THE REHABILITATION OF A BADLY DAMAGED SEWER

A Concrete Sewer Made as Serviceable for Acid Wastes as for Storm Flow

By WM. D. DARBY*

Consulting Engineer,
West Allis, Wisconsin.

The Author

A 60-INCH monolithic concrete storm sewer constructed nearly twenty-five years ago in West Allis, Wis., was also used for the disposal of the waste of industrial plants, including pickling acids and other wastes of metal working plants.

The concrete in the sewer, although of good quality, could not resist the concentrated acid condition which occurred during the dry weather flow of principally industrial wastes. When I was appointed City Engineer of West Allis, I discovered that the industrial waste was disintegrating the invert of the sewer and, after repeated efforts, secured an appropriation to make the needed repairs.

The condition of the sewer at the time revealed in Fig. 1, showing a temporary industrial railway track which we used in conveying the materials needed for the repairs. In the foreground of this picture is shown a condition where the concrete was entirely eaten out for the width of the entire floor and the ground is eroded away to a depth of about 2½ feet below the original floor level of the sewer. This condition existed, with a varying width of destroyed floor, for a distance of about 2,100 feet. A total length of 2,420 feet was in need of repair.

A thorough study was given to the problem of repairing the sewer, which involved providing a liner that would resist the acid condition up to the point where storm water would sufficiently dilute the acid wastes to make them harmless to the concrete. The following plan was finally formulated and put into execution.

*The author is also City Engineer of West Allis.

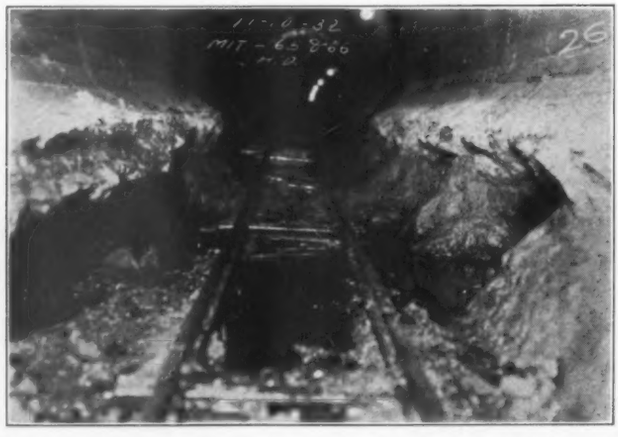


Fig. 1.—West Allis Storm Sewer—Built in 1913—Condition 1932 as Result of Acid Wastes from Metal Working Plants.

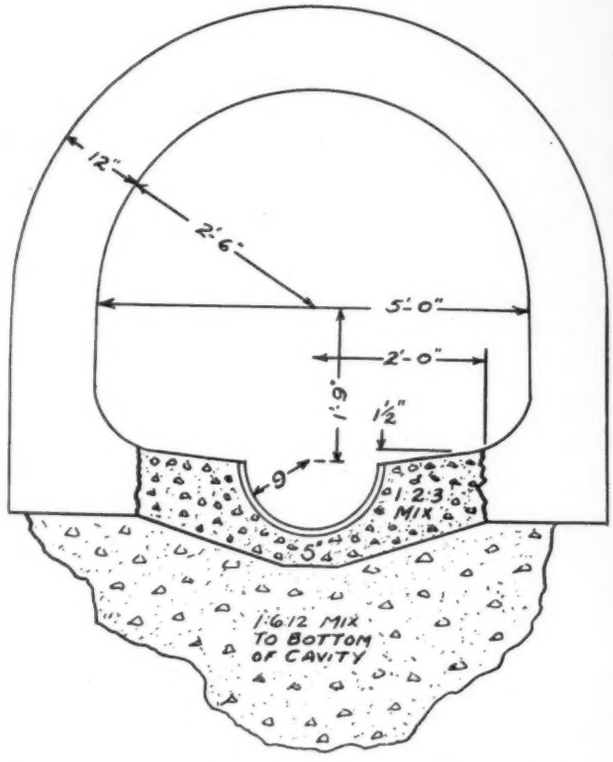


Fig. 2.—Cross Section Showing Details of Repair Work and New Invert of Vitrified Half-Round Sewer Pipe.

Repair Methods Considered—That Adopted

Preliminary to the actual repairs on the sewer the space where the soil had eroded away was filled in with an inexpensive grade of concrete consisting of one part of cement, six parts of sand and twelve parts of stone. With this concrete the space was filled as illustrated in Fig. 2, which shows how the concrete filling extended under the walls of the sewer. The floor of the sewer, except for a space in the center, was replaced with concrete of a "1-2-4" mix.

To provide an acid proof liner for the industrial waste we used a half-round vitrified salt glazed clay sewer pipe of 18 inches diameter. This pipe was especially made to our specifications with two longitudinal keystone shaped ribs running the full length of the under side of the pipe. These ribs were specified in order to provide secure anchorage for the pipe in the concrete.

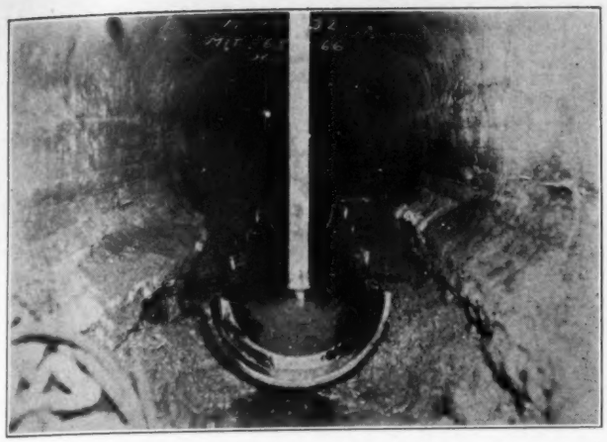


Fig. 3.—Placement of Vitrified Half-Round Pipe to Form Invert for Industrial Waste Flow Plus Some Storm Dilution Before Overflow Onto Concrete Floor. (See Fig. 2, Showing Sketch of Completed Job.)

We used a bituminous jointing compound, known under the trade name "G-K" compound, for jointing the pipes. It was easy to pour and had great strength, as was shown in a severe test.

Fig. 3 shows the placement of the split clay pipe in the concrete, with one of the rods used to hold the pipe in place while setting. This work was largely done at night, when the industrial sewage flow was at a minimum.

Fig. 2 shows a sketched cross-section of the reconstruction job.

These split pipe liners have proved entirely satisfactory after more than four years in service. They provide an adequate channel to carry the industrial wastes in dry weather. Normally these wastes do not reach the concrete of the main structure. In rainy weather when storm water is being carried off and the flow reaches a higher level in the sewer the destructive acid is so diluted as to be relatively harmless to the concrete.

Before the plan for using split clay pipe, as described above, was carried into effect, an experimental section of corrugated iron sewer channel pipe 136 feet in length was installed. This pipe was of the best grade available and nine separate protective coatings were applied to protect the pipe against the destructive elements in the industrial waste. These coatings disintegrated after a few months.

For 90 linear feet the new concrete invert (about one-fourth the diameter of the sewer) was protected with vitrified salt glazed clay liner plates at a cost of $284.33 or $3.317 per foot.

The cost of the 2,194 feet of split clay sewer pipe construction was $6,762.98 or $3.2366 per foot. The total cost of the entire project (2,420 feet) was $8,445.78 or $3.4901 per foot.

It is regrettable that when this sewer was first built the acid condition was not anticipated. At that time an acid proof vitrified clay liner could have been built into the invert of the floor at an additional cost of probably less than 70 cents per lineal foot. This measure would, without much doubt, have eliminated the subsequent repair job which cost several times as much.

For the efficient manner in which this project was executed and the trouble-free service which it has given since, much credit should be given two members of my staff, Edward P. Sheahan and Joseph D. Dunlap, the engineers in charge of operations.

(*Although Mr. Darby lays no claim in his article to the fact that the scheme adopted was his own idea, we understand that the idea originated with, and details were worked out by the author.—Ed.*)

▲

Ben Tippins to Run Activated Alum Plant

Ben Tippins

Ben F. Tippins, well known to water works men as Superintendent of Water and Sewerage at Daytona Beach, Florida, has been made Plant Superintendent by the Activated Alum Corporation, whose new plant at Curtis Bay, Md., is rapidly nearing completion. The new plant will produce filter alum and "Black-Alum," the latter being a compounded filter alum containing activated carbon. Among the novel features of the plant the most important is the continuous process, rather than a batch process of making alum.

Mr. Tippins was the first water works operator to conceive the value of a compounded alum-activated carbon coagulant and also the earliest user (1931) of the product now known as "Black-Alum." He became water works superintendent at Daytona Beach in 1908, and was one of the organizers of the Florida Section of A.W.W.A. which he served as a director from 1928 to 1932.

Fred Stuart, president of the company, is particularly happy that he has been able to secure his former "boss" to take charge of production of "Water Works Coagulants—Made by Water Works Men—For Water Works Men."

▼

W. R. Conrad to Head New Jersey Section A.W.W.A.; Professor Lendall Becomes Its Secretary

"Uncle Billy"

William R. Conrad, Consulting Engineer of Burlington, N. J., was named the next Chairman of the New Jersey Section of the American Water Works Association at its meeting on March 3rd, in New Brunswick, N. J.

"Uncle Billy," as he is affectionately known to his many friends, has been a member of importance to A.W.W.A. since 1904; heads its Committee on Valves, Sluice Gates and Fire Hydrants; serves on others.

Other officers named at the same meeting are:

Vice-Chairman—Geo. G. Weighart, Hydraulic Engr., Hackensack Water Co.

Sec'y-Treas.—Prof. H. N. Lendall, Rutgers University, New Brunswick.

Trustee—Charles H. Capen, Jr., Engr., North Jersey Water Commission.

SLUDGE DISPOSAL BY INCINERATION

Part II—Heat Values of Sludge—Types of Incinerators

By PHILIP B. STREANDER

Watson and Streander,
New York, N. Y.

This is the second installment of a continued article, which deals with the theory and practice of "Sludge Disposal by Incineration."

The first installment, which appeared in our January, 1937, issue, reviewed the history of incineration and discussed modern methods of dewatering of screenings and sewage sludges preparatory to drying and burning. The present article discusses the heat value of sewage sludge and describes one type of incinerator. The next installment will be devoted to a description and discussion of the operation of the mechanically rabbled multihearth incinerator and other types.—Ed.

IN CONSIDERING the incineration of sewage sludge a knowledge of its composition, together with the volatile and fixed carbon, is qute essential in the determination of combustion requirements. In view of the recent introduction of sludge incineration as a practical method of sludge disposal very little actual and authentic information is available concerning its heat value. The chemical analysis of sludges have been determined to a considerable extent, but probably the most widely determined constituents are the volatile matter and ash contents. Available records indicate only the total volatile solids and take no cognizance of fixed carbon. Eventually it is hoped that the present meager information will be supplemented by authentic records giving volatiles and fixed carbons. It is recognized that even after these become available that considerable variations will occur in each plant. Also in combined sewer systems the ash content variation in sludges may be between 25 and 65 per cent. If an incinerator plant is designed for say a 30 to 35 per cent ash content, an increase to 65 per cent may seriously interfere with the normal operating routine of the incinerator plant.

To properly determine actual incineration requirements long time records should be available from which computation or actual determinations can be made of the heat value. In the majority of sewage plants, now constructed, such records are not available and comparative assumptions must be made with such records and information as are available to secure average heat values.

The following data are quoted to give an indication of heat values of sludges. Heat values can also be computed if the chemical analyses are available and recognition is made of the interrelation between the carbon and hydrogen in sewage sludge. Comparisons will also be made with other combustble materials to indicate the feasibility of burning dried sludge.

Studies by Fair and Moore

Studies reported by Fair and Moore (7) on sewage-sludge fuel values as related to volatile matter indicate that the fuel value can be computed with a fair degree of accuracy from the total volatile matter in the sludge. In their article several formulas were given, accompanied by tables of per cent range of error. Relationships were established that are quite useful for cases where an estimate of the fuel value is required and actual determinations of such are not available. The curves of Fair and Moore are reproduced here for convenience of reference. In Figure 7 is presented the fuel value of plain-settled sludge, both digested and undigested, from which was derived the formula

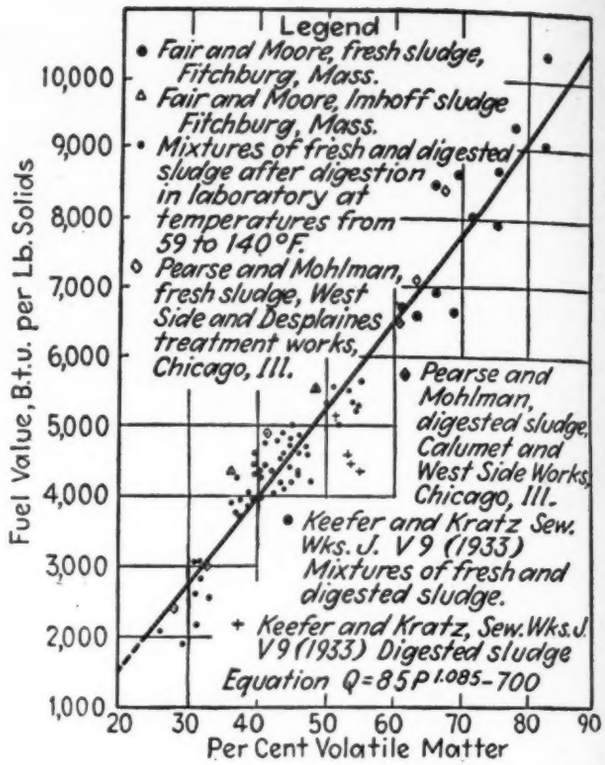


Fig. 7.—Heat Value of Plain Settled Sludge (Fair and Moore).

$$Q = P^{1.085} - 700$$

Where Q = fuel value of the sludge in B.T.U. per lb. of dry solids.
P = per cent volatile matter in dry solids.

Figure 8 gives the fuel value of activated sludges, digested and undigested, from which was derived the formula

$$Q = 69.2\ P^{1.085}$$

Fresh raw sludges have a volatile-matter content of between 60 and 85 per cent and fuel values ranging between 6,500 and 10,500 B.T.U.'s per pound dry solids. A sludge consisting entirely of volatile solids would have a fuel value of about 12,000 B.T.U.'s per pound dry solids, which can be taken as the average value per pound of the volatile matter in fresh sludge. Average raw sludges contain between 67 and 72 per cent volatile solids and have fuel values of between 7,000 and 7,400 B.T.U.'s per pound. Undigested activated sludges have a volatile-matter content of between 60 and 75 per cent

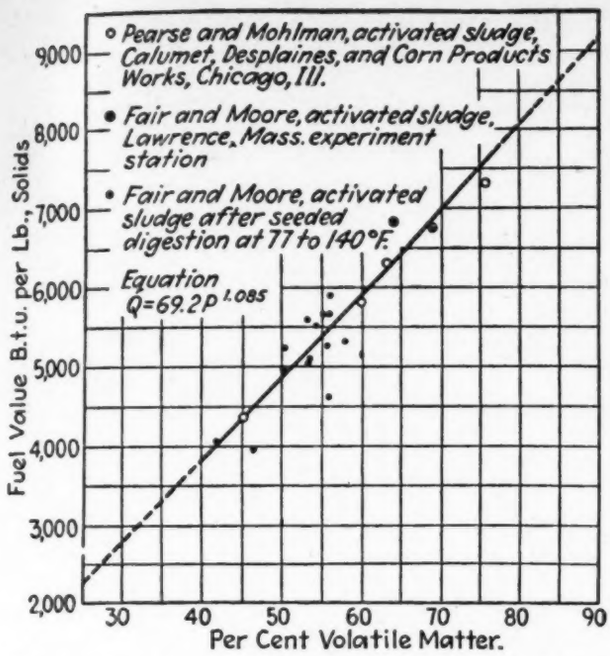


Fig. 8.—Heat Value of Activated Sludge (Fair and Moore).

and fuel values ranging between 6,500 and 7,500 B.T.U.'s per pound dry solids. While the actual heat value of the sewage matter precipitated as the result of chemical treatment of sewage is the same as for other sludges, the resulting sludge will have a lower fuel value due to the inclusion of the inert chemicals in the mixture. However, the total fuel recovered is greater by the quantity of additional combustible matter removed by the precipitant.

Studies by Stilson

Extensive studies of the incineration of sewage solids have been made by Stilson (8)-(9). His published articles give a clear presentation of the various factors involved in the drying and burning of sewage solids and covers screenings and various types of sewage sludge. These articles give heat values of the sludge and also ignition temperatures of various substances. For this particular discussion, having reference to the heat values of sludge, the following figures are reproduced:

	B.T.U.*
Paper	7,500- 8,200
Coarse bar screenings	8,500- 9,500
Fine screenings	9,500-10,500
Digested sludge	9,500-10,500
Activated sludge	10,500-11,500
Raw Sludge	11,500-12,500
Chemical sludge	11,500-12,500

*B.T.U. per pound of material on an ash and moisture free basis and represent approximate values only.

Those interested in sludge disposal by incineration will find in the article by Stilson (8) many interesting angles to the general problem.

Heat Values by Computation

Where chemical analyses are available, approximate heat values can be computed by the use of Du Longs' formula in which

$$\text{B.T.U.'s} = 14{,}600\ C + 62{,}000\ \left(H - \frac{O}{8}\right) + 4{,}000\ S.$$

In which C = Carbon
H = Hydrogen
O = Oxygen
S = Sulphur

This formula gives results within 5 to 10 per cent of actual values, as determined by calorimeter tests, and may be valuable for making approximate determinations of heat value for design work, but cannot be relied upon in thermal efficiency tests.

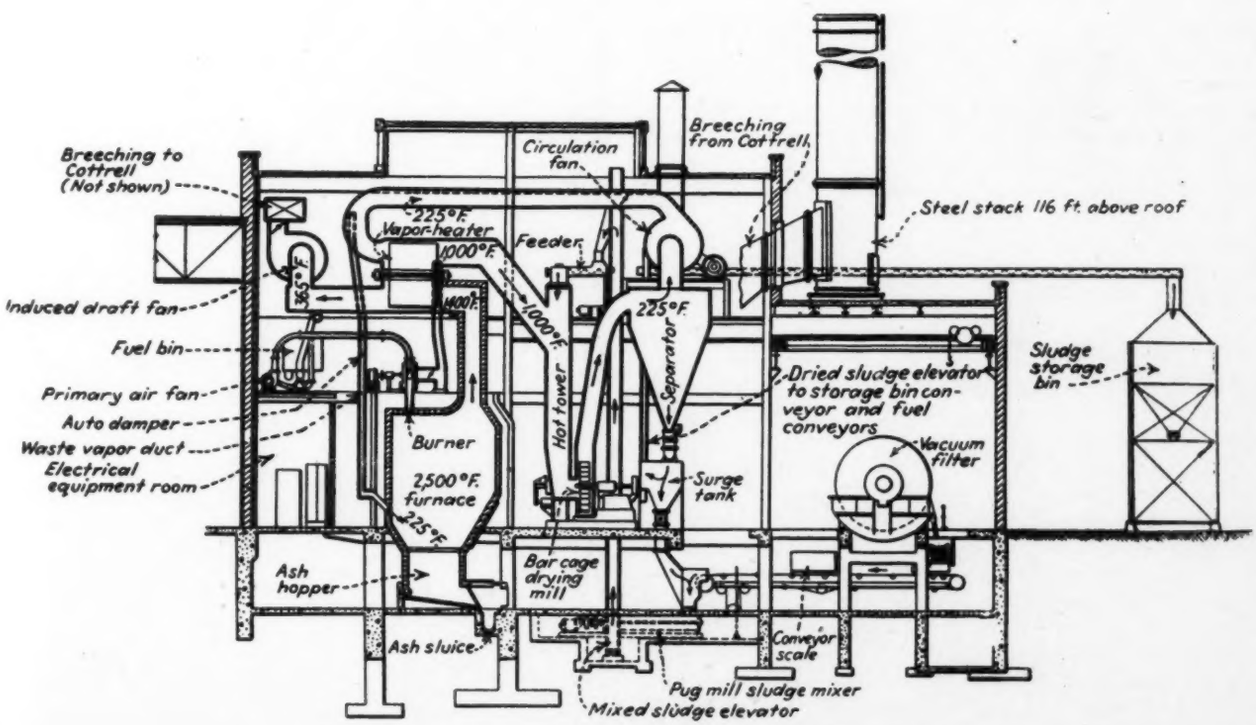


Fig. 9.—Sectional View, Chicago (Calumet) Sludge Incinerator.

Comparison With Other Fuels

Sewage sludge can be categorically classified as a low grade fuel and can be burned as such. The extent to which its heat and power values are recovered will naturally be determined by the efficiency of the drying and combustion equipment. Below are given the chemical characteristics of sewage sludge and other low grade fuels, with coal analysis included for comparative purposes. The analyses are given on an ash and moisture free basis because this arrangement gives a more accurate picture of the actual ingredients.

	CHEMICAL ANALYSIS (Moisture and Ash Free Basis)						ASH AND MOISTURE CONTENT		
	Carbon	Hydrogen	Oxygen	Nitrogen	Sulphur	B.t.u. per lb.	Ash	Moisture	B.T.U. per lb. as burned
Average Sewage Sludge	53.5	8.0	30.1	7.0	1.4	10,900	33	60	3,000*
Chicago Sewage Sludge	55.4	7.9	28.3	7.8	1.6	10,950	35	80	1,500
Garbage	52.0	7.7	34.8	3.2	2.3	10,200	4	75	2,500
Rubbish	49.0	6.0	43.0	..	2.0	8,200	40	5	4,700
Mixed Refuse	49.5	6.8	40.0	1.5	2.2	9,100	16	51	3,700
Bagass	46.0	6.0	48.0	..	..	8,500	2	50	4,200
Wood	50.0	6.2	42.7	1.1	..	8,000	2	22	6,100
Straw	45.3	6.4	47.6	0.6	..	6,500	6	16	5,300
Tan-bark	53.0	6.0	41.0	..	..	9,600	2	65	3,300
Texas Lignite	72.3	5.4	19.3	1.3	1.7	11,700	17	35	6,300
Low Grade Coal	75.6	5.8	8.8	1.2	8.6	14,000	16	13	10,200
High Grade Coal	85.6	5.5	6.3	2.1	0.5	15,500	6	3	14,000

*Optimum Dewatering.

With the exception of lignite, the carbon content of sewage sludge closely approximates that of the other low grade fuels such as bagass, wood, straw and tan-bark. Its heat value, on a moisture and ash free basis, exceeds that of bagass, wood and straw, and closely approximates that of lignite. When an ash inclusion comparison is made, the average heat value (moisture free) becomes less than bagass, wood or tan-bark, but better than straw. The actual heat value of sludge reduced to a moisture content of 60 per cent is comparable to the burning of tan-bark and to a lesser extent to bagass. Except for its high ash content it could be classified with the better known low grade fuels.

In generalizing, it can be said that the efficient incineration of sewage sludge requires some form of drying preliminary to burning that will not alone effect a satisfactory reduction in its moisture content, but will also insure a porosity which will allow a thorough passage of air, so that all parts will receive the oxygen required. A study of the analysis indicates that the burning of sludge should follow methods generally practiced in the burning of low grade fuels having a high moisture content, and in addition must be modified to cope with the high ash content of sewage sludge.

Temperatures Required

The ignition temperature of various organic substances lies between an approximate minimum between 700° F. and 800° F. and a maximum of about 1,200° F. However temperatures must be adequate for the proper combustion of the volatile constituents, which in practice is found to be several hundred degrees higher than their theoretical value. In actual practice it has been found that the lowest temperature at which volatilized odorous gases can be completely destroyed is about 1,250° F. There is need, however, for further study of temperatures required for odor destruction because some studies indicate that such may be as low as 1,100° F. This, however, applies only to odor control and has no reference to proper combustion temperatures. When the weight of the heat carrying medium (composed of flue gases and moisture) increases, the amount of heat carried per pound of the mixture diminishes and when the heat content per pound of mixture becomes less the temperature at which combustion takes place decreases. For efficient combustion temperatures should not be less than 1,500° F. and it may be necessary to maintain higher temperatures if the sludge has a high ash content. Proper combustion requires air in an amount sufficient to combine with and burn the combustibles and this air should preferably be applied in such a manner that it passes *through* the burning material and *not over* it.

The amount of moisture present in the sludge cake directly affects the weight of the heat carrying medium and the temperature of combustion and if all of the moisture in the dewatered sludge cake is present during combustion, the resulting temperature may be insufficient for proper burning. Efficient rapid drying, requires thorough exposure of small particles of sludge with the necessary air to absorb the moisture. The more complete this exposure the more efficient becomes the drying. For average sewage sludges the amount of moisture to be evaporated should be that to obtain a solids concentration of between 55 and 75 per cent and a sludge ready for combustion with a 35 per cent moisture content is considered a good average. This moisture content is based, however, on an incinerator design in which the air required for combustion is rapidly supplied to each and every part of the burning sludge.

Types of Incinerators

At the present time there are two general types of incinerators which have been developed for the prime

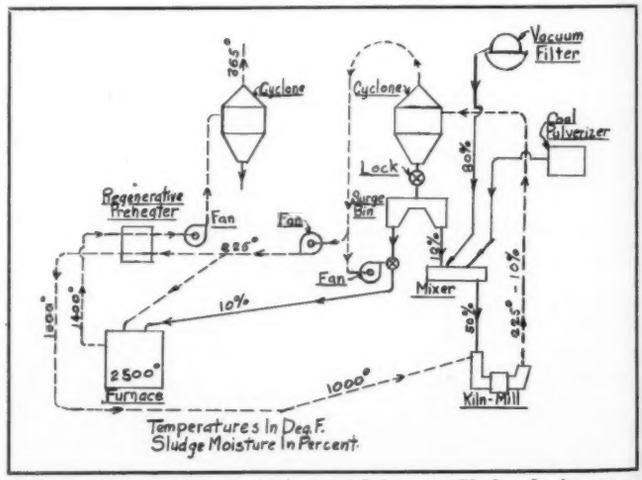


Fig. 10.—Flow Diagram, Chicago (Calumet) Sludge Incinerator.

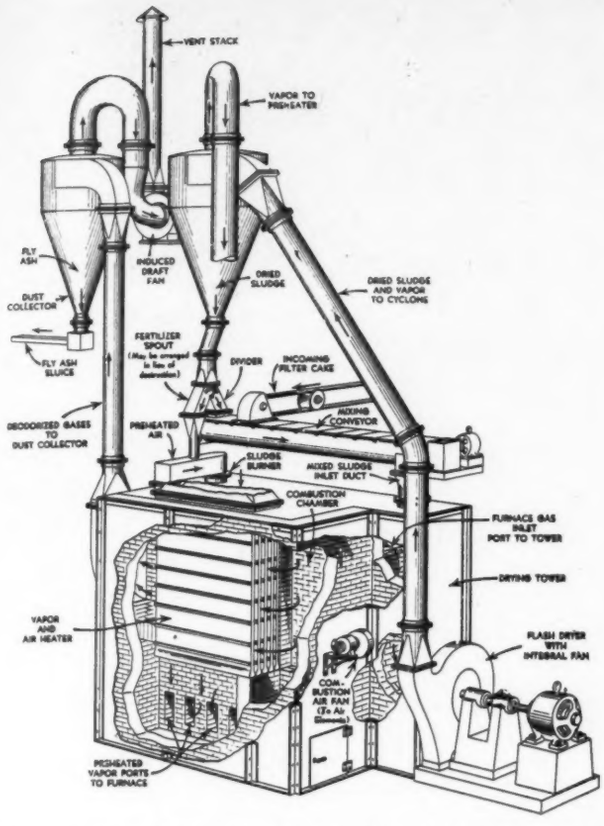


Fig. 11.—Sludge Incineration, Combustion Engineering System, for Smaller Installations.

purpose of sludge incineration. One type, represented by that of the Combustion Engineering Company, involves drying and combustion in two distinct steps and in separate chambers. The other type, developed by the Nichols-Herreshoff Company, is quite similar to ore-roasters and involves continuous drying in the upper sections and burning in the lower sections of a single unit. This type incinerator is also being produced by the Decarie Incinerator Co. Developments are also now being made by other companies which incorporate separate drying in their designs, followed by combustion in a separate chamber. In most of the newly developed incinerators, and those now under development, efficiencies of evaporation and burning range between a minimum of about 45 per cent and a present maximum of about 70 per cent. These efficiencies are secured through heat recovery from stack gases, involving adaptations of air preheaters and heat regenerators for the heating of air for drying and combustion. Heat efficiencies are calculated from the total heat recovery, including credits on stack gas and latent heat of evaporation, divided by the total heat input. In this description the Combustion Engineering Company incinerator will be referred to as the cage-mill type and the Nichols-Herreshoff and Decarie incinerators as the mechanically rabbled multi-hearth type. Other types described will be given the classification under which they fall.

Mill-Type Incinerators

The mill-type incinerator is the outcome of developments made by the Chicago Sanitary District, with the cooperation of the Combustion Engineering Company, applying knowledge and experience secured elsewhere in the drying of miscellaneous products. This system of drying was tried experimentally at Chicago's Calumet plant and the dried sludge was burned in a separate furnace. In this work it was found that better drying results could be secured by the mixing of previously dried sludge with the wet sludge cake. The operation of the burner was also improved because the resulting mixture became more thoroughly pulverized. This was followed by an actual plant installation having a capacity of 40 tons of dry sewage solids per day. Sludge cake from vacuum dewatering filters was handled at a solids concentration of 20 per cent (8). This plant (See Figs. 9 and 10) is capable of burning vacuum-filtered dewatered activated sludge, having a moisture content of 80 per cent without the use of auxiliary fuel. Three separate and complete units are provided, one of which is a spare. At the rated plant capacity the vacuum filters receive about 1,350 tons per day of wet sludge having a solids content of 3 per cent and deliver about 200 tons of sludge cake having a density of 20 per cent solids, 1,150 tons of liquid being removed by vacuum filter dewatering. The flash dryers reduce the 80 per cent moisture to 10 per cent.

Incinerators employing separate chambers, for the drying and burning of sewage sludge, generally require more power to operate than is required for the multi-hearth type. The fact that a portion of previously dried material must be mixed with the wet sludge for proper drying requires additional equipment for the handling and weighing of the returned material and the mixing of the combined material, the amount of sludge returned being usually more than twice the weight of the wet sludge, both taken on a dry basis. Care must also be taken that the amount returned is not reduced below that necessary to secure proper handling and drying. Burning the sludge in suspension requires the use of dust separators to prevent the escape of fly-ash up the chimney. All of these operations necessarily absorb power in their operation. Maintenance, repair and replacement costs with equipment operating at a high speed are a consideration. With this type of incinerator it is also essential to produce a sludge as free as permissible from grit or sand so as to eliminate as far as possible abrasion to the rotating parts.

Combustion Engineering Incinerators

These incinerators, represented by the Calumet installation, consist of all refractory furnaces built with water cooled walls, the dried sludge being fired in suspension within the furnace. The cake from the vacuum filter dewatering machine is conveyed to a mixing trough or pug-mill located near the drying tower. Here the cake is mixed with a portion of the previously dried sludge, having a density of 90 per cent in order to increase the density of the material fed to 50 per cent. This mixture is then elevated to the top of the drying tower, where it comes into contact with pre-heated vapor having a temperature of about 1,000° F. and then drops into the cage-mill or flash dryer. The cage-mill consists of a steel housing containing two sets of bar cages, one of which is stationary and fixed to the housing and the other rotated about a horizontal shaft by a motor drive. The action of the bars in high speed rotation, passing by the stationary bars, exposes a large surface of the sludge to the heated vapor and produces a so-called flash drying and reduces the temperature of the gases to about 225° F. The product of the cake-mill, a fine filamentous material containing only 10 per cent moisture, or thereabout, is separated from the gases and vapor in a cyclone separator. The required part of the dried sludge is diverted to the pug-mill for mixing with the incoming

sludge cake and the remainder is fed to the burners in the furnace.

The gases and moisture from the drying process pass through a regenerative preheater raising their temperature to about 1,000° F. On the return to the preheater there are branch ducts having automatically controlled dampers which discharge excess vapor and moisture to the furnace. Here their temperature is increased to about 1,400° F. for odor destruction whereas the combustion temperature in the furnace is about 1,800° F. The products of combustion are combined with the waste vapors from the system and pass through the preheater and induced draft fans, thence through a dust precipitator to a steel stack at the reduced temperature of about 365° F. The power required to operate the various fan motors, mixing and cage-mill motors is approximately 20 K.W. per hour per ton of liquid evaporated.

A modification of the type previously described is shown in Figure 11. This type is proposed for smaller capacity plants and, while differing somewhat from the units at the Calumet plant, contains the same fundamental features of flash-drying of pre-mixed sludges, preheating of vapors and combustion of the sludge in a separate chamber. One interesting feature of this type of incinerator is the possibility of diverting dried sludge at will, for use as a fertilizer whenever this be desired. In the latter case some auxiliary fuel must be provided to evaporate the moisture contained in the sludge. Such a diversion makes it possible to utilize sludge as a fertilizer for lawns, parks, etc., at the times when such applications are required.

In the next installment of this article will be described the mechanically rabbled incinerators.

REFERENCES

7. Eng. News-Record, May 9, 1935.
8. Sewage Works Journal, January, 1935.
9. Public Works, May and June, 1935.

(To Be Continued.)

▼

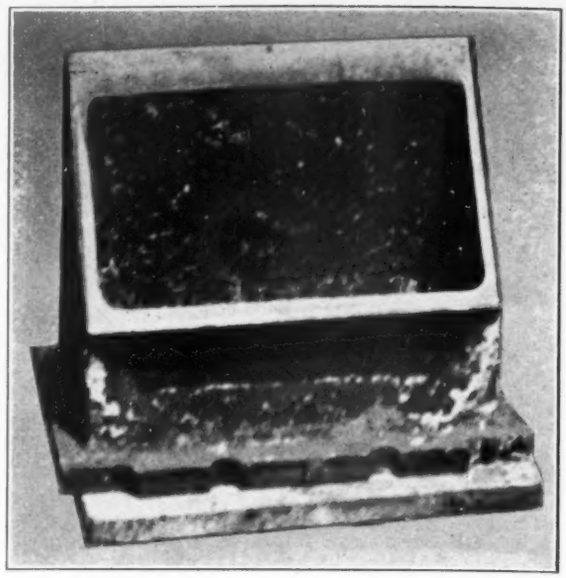
Bronze Resurfacing of Worn Valve Parts

The following information from Linde Air Products Company's Technical Service Department seems worthy of passing on to our readers.

Bronze welding rod was recently used in resurfacing 900 sewer valve cages by one Eastern municipality. It was estimated that it would have cost $31,500, approximately, to replace these worn cages. In contrast, an approximate labor and material cost of $12 per cage was the cost of the reclamation project by the oxy-acetylene bronze refacing process. A net saving of roughly $18,000 was realized, according to the reports.

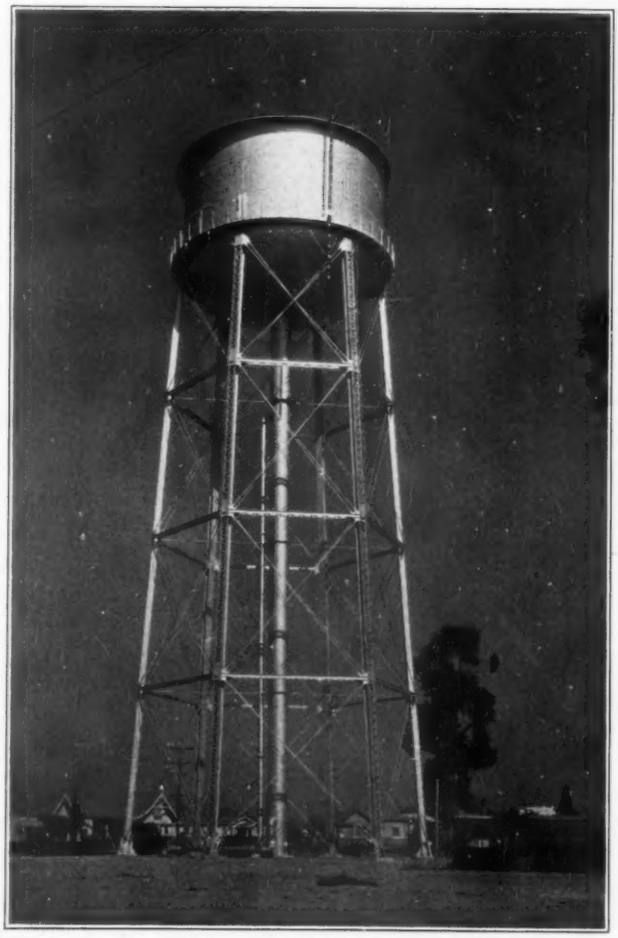
The worn valve cages (here pictured) were manganese-bronze castings about ½ inch thick. The continual hammering of the valve covers had resulted in pronounced wear on the two cage faces. One of these faces is perpendicular to the axis of the valve, while the other is at an angle of 45 deg. Each surface required about 37 inches of bronze re-surfacing.

Other than a quick wire-brush cleaning of the faces, no preparation for the welding was necessary. Each casting was preheated for about 10 minutes in the oxy-acetylene flame. Thus prepared, one experienced welding operator could completely rebuild both faces in 30 minutes. About 4 lbs. of bronze welding rod was used on each face.



Example of Bronze Resurfacing of Worn Valve Joint

This experience would certainly indicate that the possibilities of renovating worn equipment by the simple and inexpensive bronze-weld resurfacing process is deserving of consideration before replacements of worn machine or valve parts are decided upon.



An Attractive Picture of a Pleasing Elevated Tank. One of California Water Services Company's Tanks. Photo Courtesy of Chicago Bridge and Iron Works.

A.W.W.A. Anticipating Largest Convention in Its History

ALL SIGNS point to the fact that the 1937 Annual Convention of the American Water Works Association, to be held in Buffalo, N. Y., June 7-11, is to be the best attended of any convention in its history. Already the Statler Hotel reports that it has reservations on file for 500 of its rooms and that, passing expectation so early, it will soon be necessary to refer inquiries to the several nearby hotels.

Feeling that it would have to look far for another, capable of handling entertainment as well and for so little net expense per member as has "Bill" Orchard, the Convention Management Committee literally drafted "Bill" for "at least one more year" to take charge of convention entertainment. Those who were at the 1936 Convention in Los Angeles or the New England Association Convention in New York City will appreciate why.

A feature in the way of 1937 entertainment is the half-day excursion planned to Niagara Falls and the dinner and an evening of dancing and divertisement "Abroad"—that is to say, on the Canadian side of the Falls. The day will end with a special illumination program which makes Niagara Falls a new spectacle at every change of the vari-colored searchlights—the most stupendous "Water Works Show," or works-of-water show, on earth. The all-day golf tournament has been arranged at the attractive Niagara Falls Club on the Lake for the same day (Wednesday) and all will join together again for the large evening and return to Buffalo about midnight. Aside from the afternoon of sight-seeing many of the men-folks will take a special opportunity, not usually accorded visitors, to go through one or another of the chlorine producing plants in Niagara Falls. Others will want to visit some of the varied industrial works of Niagara Falls such as Carborundum Company's air diffuser and filter underdrain plant, or possibly the new Niagara Falls sewage treatment plant, which embodies a novel method of sewage filtration and incineration. Also, filtration plants are on both sides of the "divide." So, the Niagara Falls excursion has the value of technical display as well as scenic beauty and "An Evening Abroad." This program replaces the Wednesday evening "Smoker," of previous years, in which there was too much smoke and too little fresh air. Also, the dinner in Canada is something additional. The balance of the Entertainment Program will be essentially that of previous conventions, ending with a bigger and better closing dinner-dance and show—a la Bill Orchard—with less speaking, more show, and good time.

The Technical Program

Featured on the technical program is the symposium on "What Cost Floods," in which water plant operators will vividly recite by word and picture what the 1937 Ohio River Flood cost them and their communities. As a sequel, the matter of "Preparedness for Emergencies" is to be dealt with by operators and managers who have had to face a variety of emergencies and catastrophes such as flood, drought, hurricane, earthquake, major conflagration. Another topic of allied consequence is that of "Water Resources Planning" in which A. W. W. A. will hear, at first hand, what Federal and State agencies are planning to do or should do to correct the recurring flood and drought damages suffered in America, with increasing frequency.

Of interest, and deserving of the ear and voice of every water works operator, is the symposium devoted to improving the condition and security of *all* water works operators. Such for example are the matters of providing job and old age security through the establishment of Retirement Pension Systems in city-owned water departments and the matter of "Operator Licensing"—what it means and where it will probably lead.

Of importance, to those charged with finance and accounting, is that part of the program devoted to a discussion of important chapters now under preparation for the forthcoming "Manual of Water Works Accounting Practice"—a joint production of A. W. W. A. and the Municipal Finance Officer's Association. This is by far the most important consideration on the program of the Finance and Accounting Division, which will also hold a critical "Round Table" on the manual chapters.

The Water Purification Division always has topics of timely importance to present and discuss, but nothing can be of higher universal importance to water works men at large than "Corrosion Control." This topic, again, is the subject of a symposium in the joint session for Superintendents and Chemists. What's new in corrosion control and what's further needed in this direction will be discussed by those who know from first-hand experience. Then the symposium on "Softening of Municipal Supplies"; what it means to water consumers; what it costs the water utility; what are the most recent developments; why hard water is still tolerated—all will be discussed. Taste and odors, always with us, have again a justified place on the program, in order that the highest accomplishments, the best economies, and most useful processes for their control may become even better ones a year hence.

The Technical Program, although essentially completed, is not ready for release in full as we go to press with this issue.

Transportation and Arrangements

Under A. W. W. A.'s "Old Reliable" John S. Warde, 50 Church St., New York City, transportation facilities to the Convention and to Niagara Falls are being arranged to best serve those who are planning to come to Buffalo June 7th. Special trains and rates are being arranged. If he can help you, drop him a card for further information.

Chairman of the Convention Management Committee is Rollo K. Blanchard, Neptune Meter Co., 50 W. 50th St., New York City.

Chairman of the Technical Program Committee is Linn H. Enslow, WATER WORKS & SEWERAGE, 155 E. 44th St., New York City.

Chairman of Entertainment is W. J. Orchard, Wallace & Tiernan Co., Newark, N. J.

From Los Angeles will come W. W. Hurlbut, President of A. W. W. A., and, from all reports, he is bringing most of the California Section with him. There is some talk of a "special" coming through from the Pacific Coast.

From Canada, will come the new Director, A. E. Berry, bringing with him a "big chunk" out of the Canadian Section. From Texas: Director John Winder, with his gang. From Florida: "Doc" Black, another new Director, with a pack of "'Gators." From Idaho: "Bill" Hughes, with a sack of Jumbo 'Taters. From Maine: Harry Fuller, President of the New England Assn. From Virginia: "Gene" Dugger, President-Elect of A. W. W. A., and Marsden Smith, his successor as Director. From Georgia: "Bill" Rapp, to be made Honorary Member, and "Bill" Weir, Director.

PRACTICAL ELECTRICITY IN THE PLANT

A.B.C.'s of Electricity for the Water and Sewage Works Man—Article No. 4 of a Series

By MARSDEN C. SMITH, E.E.,
Engr. of Water and Electricity, Richmond, Virginia

This is the fourth and concluding instalment of a series of articles by Marsden C. Smith, designed to give operators and engineers an insight into the A.B.C.'s of "Practical Electricity" in water works and sewerage plants. The series began in our October, 1936, issue and has run in alternate monthly issues since.

The author, a graduate electrical engineer, has come to be known as an outstanding water works operator. He was, thereby, peculiarly well fitted to meet our request for the series of short articles for the benefit of operators, engineers and chemists, less well grounded in electrical matters as they apply to water and sewage works design, operation and maintenance.

It is our desire and expectation to continue to offer series of such practical articles as this one by Mr. Smith has been. A similar series by P. S. Wilson, dealing with "Elementary and Practical Hydraulics," was temporarily interrupted but is now again running. If our readers have any suggestions to offer, or preferences to state in respect to series of the above nature for future issues, we will be happy to hear from them. Needless to say, we will do our part to meet the requirements of the majority of our readers.—Editor.

ALTERNATING current motors are of two general types: the synchronous and induction. The main difference between these two types is that, while the synchronous motor can run only at a definite constant speed (synchronous speed), the induction motor must operate at a speed dependent upon the load applied, but never at synchronous speed. There are other important differences that, to better advantage, will be mentioned later.

The Author

Synchronous Motors

At a given frequency the speed of a synchronous motor may be determined by the equation;

$$N = \frac{120f}{P} \quad \ldots\ldots\ldots (8)$$

in which N = revolutions of rotor per minute (RPM); f = frequency in cycles per second; P = number of poles.

Since the standard frequency is 60 cycles per second, equation 8 is generally expressed in the form:

$$N = \frac{7200}{P} \quad \ldots\ldots\ldots (9)$$

From this it is evident that the maximum speed for a 60 cycle motor is 7200/2 or 3600 RPM, and the speed, N, from equations 8 or 9 is known as the synchronous speed of the motor. This, for 60 cycle motors, is the constant 7200 divided by the number of poles; and, since the number of poles must be an even number, synchronous speeds become 3600, 1800, 1200, 900....RPM. One of the greatest limitations of the synchronous motor is that it cannot be built to operate at other than synchronous speeds, when oftentimes an intermediate speed is needed.

On the other hand, the fact that it runs at an exact speed is quite frequently its greatest asset. Electric clocks and timing devices depend upon this characteristic for their value and dependability as to accuracy. Pump drives, and mechanical devices of all types that require an exact and fixed speed, necessitate the use of the synchronous motor for this reason.

Another marked difference between the synchronous and induction motor is that the former requires salient magnetic poles, excited (magnetized) from a source of direct current; whereas, the induction motor has no such poles and requires no separate excitation. In fact, the standard squirrel-cage motor is well named, because its rotor is essentially nothing more than a circle of bars parallel to the shaft which are held in place and short-circuited by two metallic rings. Picture the revolving cage for the squirrel's exercise and you have it—thus, the name.

Most synchronous motors have a modified squirrel-cage winding to aid at the time of starting. Hence, at starting, this motor is essentially an induction motor; but when the magnetic poles are energized from the direct current source, they become locked in step with the stator currents, much in the same manner as do the teeth of two gears.

Unfavorable Characteristics

The necessity for this auxiliary direct current is indeed unfortunate, because direct current generators are difficult to maintain. Hence, greater skill and maintenance are required for synchronous than for induction motor operation. Then, too, the starting characteristics of the synchronous motor are rarely satisfactory. The starting torque (that is, the twist or pull) cannot approach that of the induction motor; frequently necessitating expensive and complicated methods of holding the load off the motor until it has reached full speed. Fortunately, centrifugal pumps may frequently be started under no-load without inconvenience, which renders this deficiency of the synchronous motor of no real importance.

Favorable Characteristics

On the favorable side of the ledger, the synchronous motor does possess the ability to operate with a "leading" power factor, contrasted to the rather decidedly "lagging" power factor of the standard induction motor. As has been stated previously, many power companies offer a lower rate to consumers whose requirements make permissible a desirable power factor. Where this is the case, the ability of the synchronous motor to operate at the "leading" power factor may have influence in the selection of the type of motor to be adopted.

From the above, it can be seen why, for water works and sewage treatment plants, the use of synchronous motors is frequently advised against. They are only to be considered when exact speed is essential or power costs may be lowered appreciably by the favorable power factor. Even then, the engineer will do well to be certain that savings in power bills will offset the increased operating difficulties that are certain to be realized in the use of synchronous motors.

Induction Motors

The induction motor differs from the synchronous type in that it requires no separate excitation, and its ability to operate at a variable speed, as contrasted to the constant speed synchronous motor.

At no load an induction motor will run almost up to its synchronous speed. It should be understood that while the induction motor has no salient poles, the stator is wound to produce two, four or any even number of poles, just as is the stator of a synchronous motor; hence it has a synchronous speed of 3600, 1800, 900 RPM, just as does the synchronous type.

As the load on an induction motor is increased, the speed gradually lessens until at full rated load the speed is reduced from two to four per cent of its synchronous speed. Thus a given motor may have a synchronous speed of 1200 RPM, a no load speed of 1199 RPM and a full load speed of only 1170 RPM. If the load is further increased, the "slip" (as the loss of speed is called) will increase until a definite value is reached, at which point the motor will come to a stop. This load is known as the "pull-out" load.

Favorable Characteristics

Standard induction motors have very favorable starting characteristics, requiring relatively a small starting current and producing 200 or more per cent of full load torque. They are the most rugged and reliable of all motors. But while they will successfully operate under most adverse conditions, reasonable care should be taken to keep the air ducts and windings free from lint and dirt. The oil in the bearings must be flushed and changed at least once each year.

Smaller and specially designed induction motors require no starting device, and may be started by applying normal full voltage. Larger motors require reduced voltage for starting, which is usually obtained from auto-transformers, called starting compensators. Two coils, each on an iron core, are connected open-delta across the three-phase lines; a 40, 50 or 60 per cent tap is taken to the motors for starting. After the motor has started and reached a constant speed, the compensator is disconnected and full voltage goes to the motor.

Variable Speed Motors

The wound-rotor induction motor, for operating at variable speeds, is not so rugged as is the standard squirrel-cage type. It is more expensive and also usually less efficient. A misunderstanding of the speed characteristics of these motors has caused no end of trouble. We may gain a clear conception of the speed variation of the wound rotor, induction type motor if we think in terms of "slip." As stated above, the standard squirrel-cage motor "slip" varies from virtually nothing at no load to about 3 per cent at full load. With the wound rotor, external resistance may be added to the rotor circuit, the effect of which is to *increase* the slip. Hence, this motor will run at essentially *constant* speed at no load, regardless of the amount of external resistance introduced in the rotor circuit. But, as the load is applied, and the greater is the external resistance, the more rapidly will the speed drop off.

Practically, this means that if we desire to drive a centrifugal pump at a variable speed, in order to vary the head and quantity delivered, we must first learn from the pump manufacturer both the speed and the horse-power required by the pump for each value of head-quantity desired. This data is then furnished the manufacturer of the motor who will design the external rotor resistances so that the various controller positions will connect the correct resistance to cause the speed to be that needed for the pump to operate under the desired condition.

Since power is a product of speed and torque, it should be remembered that less horse-power output can be obtained from a motor operating at a reduced speed than at its normal full speed. The reduction in motor output is approximately proportional to the reduction in speed. This fact should be considered at the time of purchase in order to be certain that the motor will not be excessively heated when operating at any of the reduced speeds. The same resistors that serve for speed control are also used for starting, hence no compensator is required as is the case for some of the standard squirrel-cage types.

Motor Ratings

The rating of most electrical apparatus such as motors, transformers, etc., is based upon the temperature rise that will occur when the device is operated continuously under normal full load and normal voltage conditions. Many manufacturers recommend a limit of fifty-five degrees centigrade rise, while others base their estimates upon a rise of only forty degrees. After all, this simply means that with a given motor rated at 100 HP, at 40 degree rise would be rated at 125 HP at 55 degree rise. All things considered, it seems to be the consensus of opinion, and dictate of wisdom, that all important motors in water works and sewage treatment plants should be purchased for a guaranteed rise, not to exceed forty degrees centigrade.

▼

Harvey P. Jones Enlarges Engineering Firm

Harvey P. Jones, well known consulting engineer of Toledo, Ohio, having recently found it necessary to enlarge his organization, has established the Harvey P. Jones Company Engineers. In so doing he has added two new partners—Richard M. Batch and Harold A. Stepelton. Mr. Batch is a native of Toledo and graduate of Ohio State University. Mr. Stepleton, who hails from Lima, Ohio, is a Purdue graduate. Mr. Jones, himself, a son of Toledo and graduate of University of Michigan, was at one time connected with the late and eminent engineer, Geo. W. Fuller. He established offices of his own in Toledo in 1926, designed and supervised the sewage treatment works of Toledo, Lima, Findlay, Battle Creek and others; and several water purification plants, including the Findlay plant of which he can justly be proud.

INDIANA SECTION HOLDS RECORD MEETING

(*Excerpts from a Report by H. A. Faber, Associate Editor*)

A NEW attendance record was established for the Indiana Section of A.W.W.A. which held its 30th Annual Meeting March 25th and 26th in Indianapolis.

John L. Ford
Pres. Elect

Brief accounts of cold-weather troubles suffered during the winter of 1936 and the results and aftermath of the 1937 flood disaster along the Ohio revealed that Indiana water works operators have experienced more than their share of troubles during the past year.

Harry E. Jordan, a home-town boy who had come back home as Executive Secretary of A.W.W.A, spoke at the annual dinner. His topic was the plan and activities of A.W.W.A. in its aim to become more energetic, influential and benefiting to water works operators and executives. Later in the meeting Mr. Jordan also spoke on the topic, "Flood to Drought and Public Works Planning," in which he emphasized the fact that, regardless of importance and dimension, every water supply project actually involved the consideration and effects of land usage as a companion circumstance to water usage and conservation. To preclude recurring flood and drought, brought on by disregard of land usage, proposed headwaters storage reservoirs would produce limited results as correctives. In the end, the water-retaining capacity of the land must be maintained or restored through adjustment of land utilization and occupation.

Gadget Contest Winners

In the gadget contest an ingenious "Leak Detector" devised by Kenneth Thompson, Northern Indiana Power Co. (Wabash), took first prize and cash award. The detector consisted of a phonograph disc and needle connected to a physician's stethoscope. Second prize was voted the "Long Distance Rock Grabber," for removing stones, etc., from the depths of curb and meter boxes. The inventor was H. W. Niemeyer, of the Indianapolis Water Co.

Round Table

Before the opening Round Table were presented some brief papers revealing lessons learned during the severe cold weather of 1936 and corrective measures taken then and since.

W. C. MABEE said that in Indianapolis a new and hitherto unknown depth of frost penetration had been established, making it necessary to lower many of their mains and set new depth specifications. Almost three meters at the curb had frozen to one inside the customers' premises. Taste troubles had resulted from ice blankets over the water source. Alum and activated carbon requirements had mounted but, even so, tastes and odors had not been completely eliminated.

WM. H. DURBIN, Supt., Terre Haute Water Co., said that based on experience of 1200 meters frozen at the curb to 200 frozen on the consumers' property, they had adopted the practice of locating all meters in the cellars of the customers. 11.4% of their meters had frozen.

H. S. HARTSMAN, Supt., Public Service Co. of Indiana, related difficulties in 18 small towns served by his company. Dead ends had been since eliminated as far as practicable. Others had been equipped with bleeders. To keep the water in the mains warmer frequent intermittent pumping (wells) had proved a help in time of danger. Normally all pumping to tank or standpipe had been done at night, thus allowing the water to get chilled to almost the freezing point.

Water Treatment

In this division space limitations necessitate a mere listing of topics and speakers. That the interest was great was evidenced by the numerous questions from the floor and inadequacy of discussion period allotted.

By Professor R. B. Wiley, Dept. Sanitary Engineering, Purdue University: "What Supply Improvements Are Most Needed in Indiana."

By Eskel Nordell, Engr., Permutit Co., New York: "Iron and Carbon Dioxide Removal."

By Chas. P. Hoover, Supt. of Purification, Columbus, Ohio: "Municipal Water Softening Practices."

By Harry A. Faber, Asst. Engr., the Chlorine Inst., New York: "Modern Water Chlorination—Sterilization and Other Functions."

The 1937 Flood Disaster

Needless to report, this was the topic of most timely interest on the program and to it was devoted a two session symposium covering the following::

"The Ohio River Flood of 1937—Precipitation and Forecasts"—W. C. Devereaux, U. S. Weather Bureau, Cincinnati.

"Sanitary Conditions in the Flooded Area"—J. K. Hoskins, San. Engr., U.S.P.H.S., Cincinnati.

"Federal Plans for Flood Control in the Ohio Basin"—H. H. Cole, Engr., U. S. War Dept.

Some Lessons for Water Plant Builders and Operators"—L. R. Howson, Cons. Engr., Chicago.

"Flood Protection in the Ohio Valley"—Chas. Brossman, Cons. Engr., Indianapolis.

"Operating a Water System Under Flood Conditions"—J. C. Crenshaw, Vice Pres., Am. Water Wks. & Elec. Co., New York City.

Then followed experiences by operators under the general heading:

"Damage to Water Plants—Problems in Restoring Service"—L. S. Vance, Ch. Engr., Louisville (Ky.) Water Works; H. S. Hortsman, Supt., Public Service Co. of Indiana; Chas. Streithof, Supt., Evansville (Ind.) Water Dept.

Officers 1937-38

Chairman, John L. Ford, Ford Meter Box Co., Wabash.

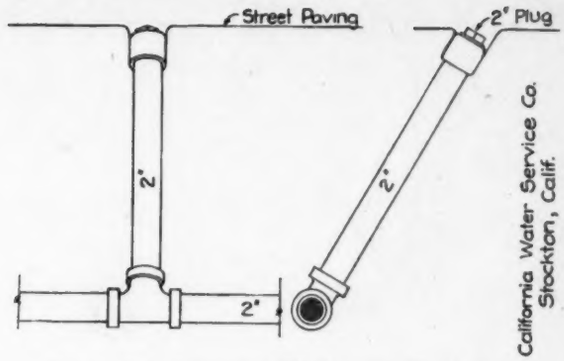
Vice Chairman, Paul C. Laux, Supt., Filtration, Anderson.

Secy.-Treas., John A. Bruhn, Engr., Indianapolis Water Co.

A.W.W.A. Director, Wm. C. Mabee, Ch. Engr., Indianapolis Water Co.

COMPRESSED AIR FLUSHING OF SMALL MAINS

By R. F. BROWN
Plant Manager, California Water Service Co.
Stockton, California



RISER CONNECTION TO 2" MAIN FOR FLUSHING

MANY water systems in the older California towns, like Topsy, just grew without any suggestion of planning for the future. Stockton was no exception. As a consequence we found ourselves with a great many 2-inch lines in the thinly populated areas.

R. F. Brown

We have for many years followed the practice of flushing small mains and all dead ends regularly by opening fire hydrants and flusher valves and simply allowing the water to flow from the main under normal pressure of 45 pounds until the main is apparently clear. Under this program all dead ends and all small mains are given ordinary flushing, approximately at intervals of every two months.

This method, however, does nothing but freshen the water in the dead ends and small mains. In order to effect a more lasting cure for taste and odor complaints, we decided to try boosting the pressure in the main with air to attempt to break loose more of the troublesome algae and other deposited material that attaches to the pipe wall. All of our dead ends, regardless of size, and at least every other block of our 2-inch lines have what we call flusher-risers installed for the convenience of our periodical flushing program—see sketch.

Air Flushing Operations

Compressed air is put into the line through a service connection midway between two flusher-risers after we have first closed the shut-off valves on the intervening services. The valve on the flusher-riser is then opened. All water in the line is forced out through the riser, by air under 90 pounds pressure. As soon as the air has expelled all the water from the line it is shut off and water under our ordinary pressure is run through the line to sweep out, through the flusher-riser, all particles of scale, sand or foreign matter that have been loosened by the air "shooting." We proceed in this manner alternately turning into the line air under 90 pounds pressure and water at 45 pounds until the flushing water leaving the risers no longer carries with it any scale or other foreign matter.

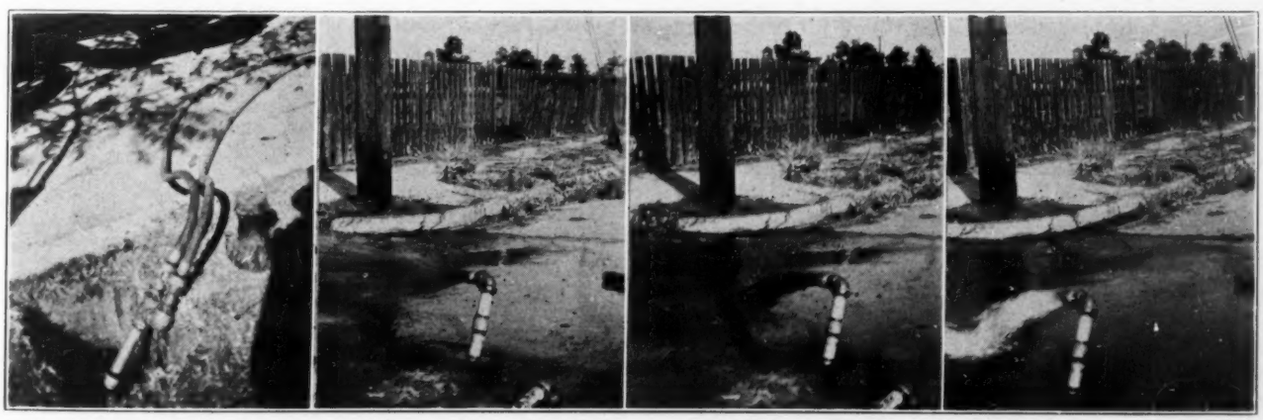
This system is apparently successful in accomplishing our purpose and it is economical, because the equipment required is only a portable air compressor and an air storage tank to provide a volume of air under pressure. No expensive cutting of mains or pavement is required and most jobs can be handled with a three-man crew.

When we first started this system we cleaned 40,000 feet of line, mostly 2-inch, over a period of two months. The cost was from 60 to 90 cts. per hundred feet, depending upon the number of services which had to be shut off and turned on again.

The success of this method of flushing is measured by the almost complete absence of the usual recurring taste and odor complaints from consumers served by mains thus treated. It is problematical how soon we will have to repeat this treatment, because from no consumer on the first line so treated has there yet developed a recurrence of complaints.

A secondary result, not anticipated, is the increase in carrying capacity of the 2-inch lines brought about by the loosening and blowing out of a great deal of scale. Thus has resulted a reduction in complaints of poor pressure as well as the taste and odor complaints.

A Self-Told Story



Air Lines Connected (This Time Through House Service at Curb Line)

First 90 Lb. Air Shot. (Note Extension Attached to Flushing-Riser)

First 45 Lb. Water Flush. (No Argument About Need to Eye or Nose)

Clear Water (Shooting and Flush Repeated As Indicated)

CLEVELAND'S EXPERIMENTAL PILOT PLANT AT BALDWIN FILTERS

By W. C. LAWRENCE[1] and MATHEW M. BRAIDECH[2]

Baldwin Filter Plant,
Cleveland, Ohio.

IT IS the purpose of this article to give a brief history and an engineering description of the experimental pilot plant operated at the Baldwin Filtration Plant.

It has been found that the so-called "bench experiments," or "jar tests," have a limited range and value in research work on certain water purification problems. In most cases, such results are roughly indicative, but at times not consistent with those that are obtained in actual plant operation. This has been particularly noted in problems involving coagulation and sedimentation, where a number of important factors may be so integrated in actual operation that it is difficult to adequately reproduce them in "jar tests" or to perceive their true importance.

The primary object in constructing and operating this experimental unit was to provide a flexible means, whereby a detailed and an exacting study of any one of the several factors involved in the treatment of the Lake Erie water could be made under, more or less, parallel conditions of the regular full-scale plant operation and treatment.

This experimental plant has been productive of many important experiments (1), reports on which have been of value to the city and were the basis of some very valuable contributions to the present day knowledge on the art of water purification.

Early Experiments Conducted

The construction of the early portion of the experimental plant was authorized by Mr. J. W. Ellms, Sanitary Engineer, Dept. of Public Utilities, to study the merits of the dechlorination and deodorization of the filtered water supply with granular activated carbon.

This experimental plant, now known as "Unit A," is located in the sub-basement of the Baldwin Filtration Plant and was placed into operation on February 16, 1928. The plant, at that time, consisted of three large wooden tanks of approximately 2,100 gallons capacity, each interconnected by piping and properly valved to give any desired detention, or hook-up, with variable rates of flow of a wide range. Facilities for chlorination were provided with Wallace & Tiernan chlorinators, and means for the application of artificial industrial and bacterial pollution were also provided. After proper treatment and detention, the water passed through a carbon filter made of 24-inch tile, where it was dechlorinated and deodorized. This experimental plant has a daily capacity of over 450,000 gallons and it could be operated at rates as low as 10,000 gallons daily. Figure 1 gives a general view of this unit.

Experiments with this portion of the plant were conducted during the period extending from February 16, 1928, to March 1, 1929, and marked the first study in this country on the use of granular activated carbon in taste and odor removal. This pioneer work involved the study of Activated Cocoanut-Shell Carbons and Surface Activated Anthracite Coal Carbon, manufactured by the National Carbon Company at Cleveland; Peat and Synthetic Bone Carbons, manufactured by the French Urbaine Corporation; and Minchar, Hammermill Waste Wood Char, and Granular Darco and Hydrodarco. This investigation involved some 2,600 samples and over 5,000 tests, and nearly 6,000,000 gallons of water were handled during the operation of the unit in this preliminary series of tests.

Fig. 1.—Unit A, Cleveland's Experimental Water Treatment Plant, Constructed in 1928 to Study Water and Odor Removal, and Dechlorination with Granular Carbons—the First Plant of Its Kind in America.

This same experimental unit was used by the technical staff of the Baldwin Filtration Plant laboratories for research work in connection with the early development work on the ammonia-chlorine process. Following which, the process was first introduced at the Division Avenue Filtration Plant on November 1, 1929, and later at the Baldwin Filtration Plant on January 4, 1930, which treatment is still in continuous operation today.

This second major investigation involved some 2,500 samples and over 8,500 tests. During the operation of the experimental plant, nearly 9,000,000 gallons of water were used. The operating results have been presented in detail before various interested groups and technical bodies (2).

During the past five years, researches were conducted with a large number of coagulants in cooperation with various chemical manufacturers. The conclusions reached in this interrupted series of experiments were in agreement with the results obtained in other filter plants of the Great Lakes region.

More recently, however, attention has been devoted largely to the mafter of effective coagulation and subsequent sedimentation during certain seasons when prolonged periods of low turbidities occur in the lake water. The trend of this series of experiments is to study possibilities of utilizing the suggested British practice toward the use of rapid-sand-filters without coagulation, as reported in an exchange paper (3) between the New England Water Works Association and the British Institution of Water Engineers. Experiments reaching conclusion at present concern the partial utilization of the above practice during periods when turbidities in the raw water are below 2 p.p.m. This occurs from 4 to 6

(1) Superintendent of Filtration and (2) Senior Chemist.
Note: Since the preparation of this article Mr. Braidech has resigned his position with the City of Cleveland to become Asst. Professor at Case School of Applied Sciences.—Ed.

months (May to October) each year, and the thought is to apply a sufficient amount of alum on top of the filters to form a preliminary mat, and none thereafter between filter washings. To preclude the possibilities of tastes and odors, the plan is to apply powdered carbon ahead of the filters; which treatment, in turn, is to be preceded by pre-chlorination of the raw water.

Along with the above preliminary studies considerable time is being spent on the design of changes and additions to the experimental plant so as to permit a more flexible study with coagulation, sedimentation, and filtration.

Details of the Re-Designed Experimental Plant

Due to the fact that a number of experimental difficulties were experienced from time to time, and that the nature of these were such as to prevent smooth and continuous operation over a 24-hour period, it was decided to rebuild and relocate the entire experimental plant to suit certain conditions of hydraulics.

In this redesigned unit, known as "unit B," every effort was made to reproduce as nearly as possible and practicable, conditions of operation such as were found in the two full-scale filter plants. The present installation comprises pumping facilities for delivering to the new experimental unit a continuous supply of raw Lake Erie water as it enters the main plant; means for mixing and coagulating the water chemically by either rapid mxing with the use of the hydraulic mixing-flume (typical of the Baldwin Plant) or the slow mixing with the use of the conventional baffled mixing-chamber (typical of the Division Plant), before delivery to the sedimentation basin; four 6-inch rapid sand-filters of the usual gravity-flow type, and continuous-feed devices for relatively small amounts of chemical solutions, carbon, and chlorine. The various units of the experimental plant are arranged and inter-connected to permit sufficient flexibility whereby any particular unit may be operated in conjunction with any other unit, or may be by-passed entirely, if desired. The output capacity of the experimental plant varies with the various units; the hydraulic-jump mixing flume, with a designed capacity

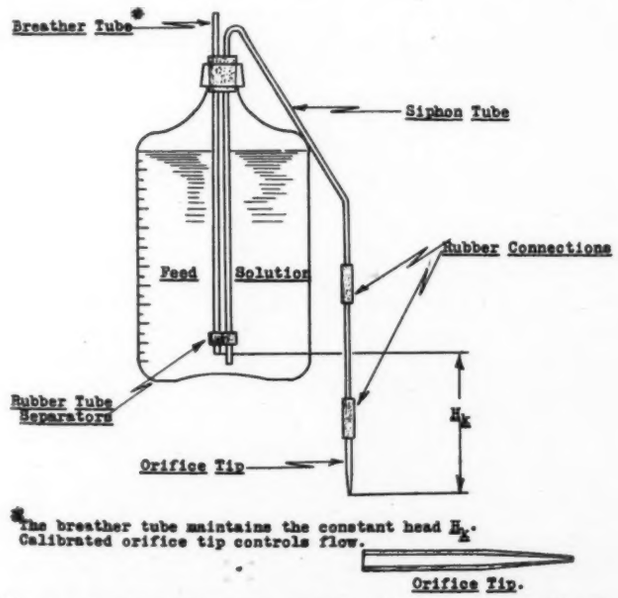


Fig. 2.—Constant Head Chemical Feed Carboy. The Calibration of the Orifice Tip Can Be Easily Adjusted by Carefully Fusing-Down or Rubbing-Down, on Emery Cloth, as May Be Required. By Proper Manipulation, the Capillary Opening Can Be Regulated to Give a Flow as Low as 5 c.c. Per Minute With Surprising Accuracy. For Such Low Flows It Is Necessary to Filter the Solution.

Fig. 3.—Experimental Mixing Chamber, Capacity 10,000 *g.p.d. Note* 12 *Gal. Constant Head Chemical Feed Carboys in Rear.*

of 200,000 gallons per day (used in 1921 experiments for the Baldwin Project), is operated at the maximum raw water delivery capacity of 100,000 gals. per day—which is the lower limit at which effective mixing will take place; the mixing chamber, because of the limited floor space, is designed for 10,000 gallons per day flow; the filters are designed for the normal rate of filtration of 2 gals. per sq. ft. of filter surface per minute with an individual output of 576 gals. per day each. The 24-inch tile filter was substituted by the four 6-inch filters, to permit the comparative study of different filtering materials and to provide for the checking of runs over the same period of test.

Raw Water Supply

The raw-water intake is located in the "rising well" of the Chemical House of the main plant. The pumping unit, located in the valve-control room, comprises a centrifugal pump with a 3½-inch suction and a 3-inch discharge, directly connected to a 10 horsepower squirrel-cage induction motor and operated by a starting compensator. The pump has a rated capacity of 200 gallons per minute against a head of 150 feet and under the present experimental conditions will deliver 260 gallons per minute against a 10-foot head.

The lower end of the intake pipe is provided with a foot valve and the discharge end of the pump connects into the drain of one of the six alum solution storage tanks, which is utilized as a head tank. In actual operation, the pump is working continuously at full discharge during the 24 hours. The elevation of the head tank is kept constant by overflow arrangements. From this head tank the raw water flows by gravity through 1,550 feet of piping to the experimental plant located in the first basement of the Administration and Filter Building.

The flow of the raw water to the experimental plant is controlled by a 3½-inch rising stem valve and measured through a 2-inch Pittsburgh water meter as it passes into a 150-gallon wooden head-tank, which functions as a "rising well," into which a 3-inch throat, connecting the hydraulic jump, is built.

Chemical Feeding, Mixing and Coagulating Devices

For feeding powdered activated carbon, an Omega Disk Feeder—Cabinet Type—with a hopper capacity of 1½ cu. ft. and a feeding range of 0.1 lb. to 2 lbs. per day, provided with 0.188 and 0.332 cu. in. groove capacities, giving ample feeding flexibility. For liquid solutions and suspensions, the feed is obtained by means of constant-head carboys discharging with a siphon

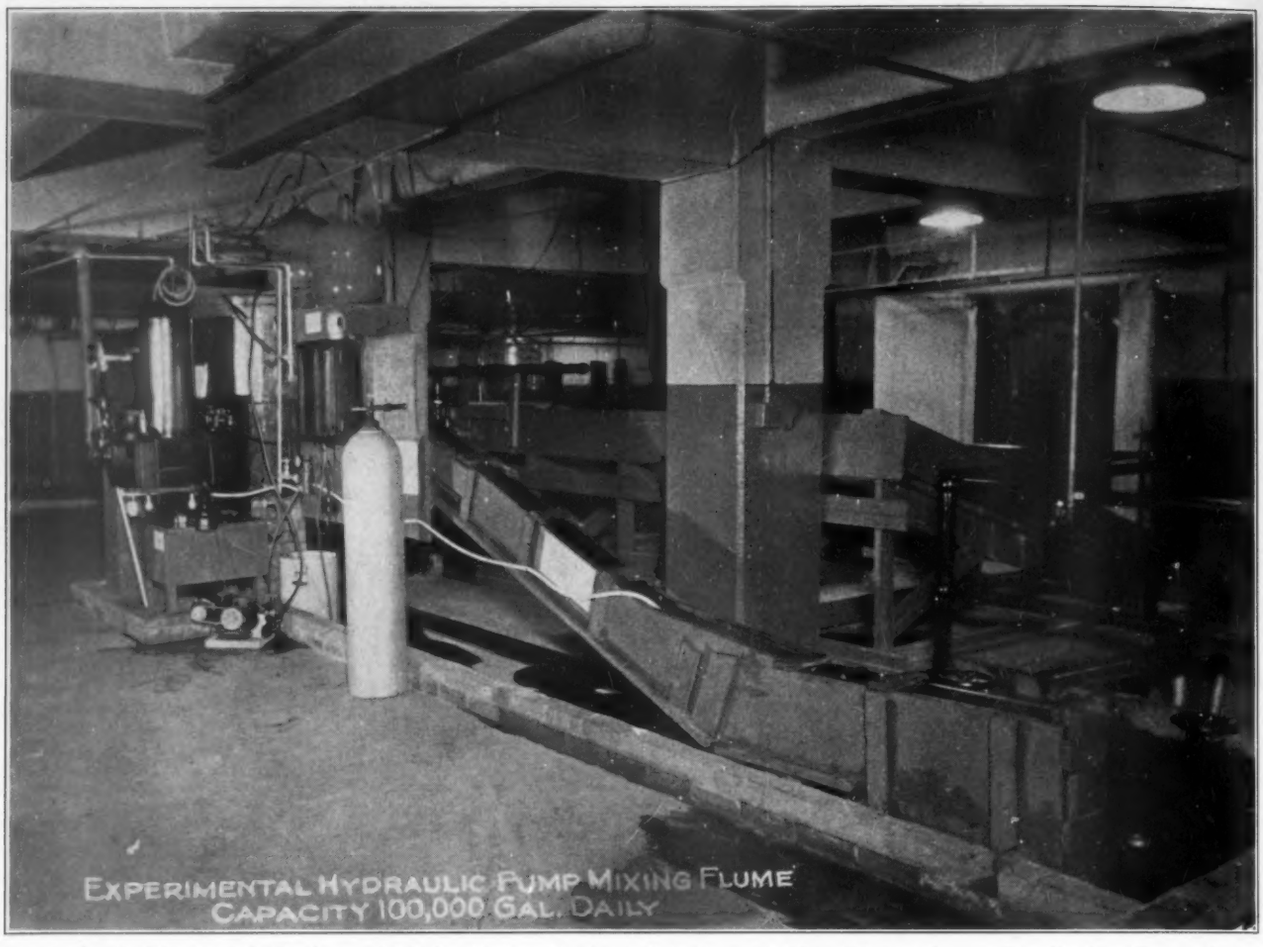


Fig. 4.—Chemical Feed, Chlorinating and Mixing Units, Cleveland Experimental Filter Plant. Omega Dry Feeder; Proportioneer's Midget Solution Feeder; W.&T. Chlorinator.

arrangement through very small calibrated orifices, a detailed description of which is given in Figure 2. With this apparatus it was possible to feed exactly 10 ml. per minute (even as low as 5 ml. per min., if necessary) and with a 12-gallon carboy, a feed could be maintained constant without any interruption for a period of 80 hrs. These carboys were graduated in liters to permit checking the feed over any given period. The applied dosage was usually controlled by increasing or decreasing the concentration of the solution. To permit continuous operation during the week-ends and holidays, two such carboys were set up for use with the hydraulic-jump and one for the mixing chamber (Figs. 3 and 4). More recently, a Proportioneer's Heavy Duty Midget Chlor-O-Feeder was provided for the higher dosages and capacities. The chlorine is fed by a Wallace and Tiernan MSAM Chlorinator provided with both a pulsating and a bubbling meter for wide range feeding. The latter two pieces of equipment are sufficiently flexible to permit application of chlorine and solutions of chemicals to any part of the experimental plant.

For mixing and coagulating the hydraulic mixing-flume, assimilating the conditions at the Baldwin Filtration Plant, and a mixing chamber duplicating the Division Filtration Plant, are used.

The arrangement of these mixing devices and their appurtenances are shown in Figures 3 and 4. The raw water to be treated approaches the mixing-flume through the rounded entrance to a horizontal narrow section, where the chemical solutions for coagulation are applied, and then passes through a 2-inch inlet-throat which leads to an expanding flume 11 feet in length, set on a slope of 0.3 ft. per ft. This flume is followed by a lower flume, 4½ inches in width and 4 feet long, into which are fitted a set of over-and-under baffles for controlling the tail-water depth to form a pool about 10 inches deep, in which the hydraulic-jump occurs with a turbulence and churning action, causing a thorough mixing of the applied chemicals. A stilling chamber, 14 inches deep and 4 feet in length, follows the baffles to divert the water to the sedimentation basin.

The water from the stilling chamber is discharged through a 3-inch pipe, the flow from which is controlled by two valves; one a 3½-inch rising stem gate valve controlling the flow of water to the 65-foot waste line, which is reduced from the 3 inches to 2 inches and discharges to the sewer waste through a 2-inch by-pass Pittsburgh water meter, which has a 2-inch gate valve adjacent to it for finer control; the other control, a 2½-inch rising stem gate valve, is used as a finer adjustment to regulate the depth of the tail water and the flow to the sedimentation basin. In this way, with the nominal flow of 100,000 gallons per day through the hydraulic-jump, 90,000 gallons per day are by-passed to the waste and the remaining 10,000 gallons per day to the detention basin and then onto the sand filters.

The hydraulic-jump may be passed by diverting the flow of water through a 3-inch outlet located just ahead of the inlet-throat, which connects to the sewer by-pass line. A 2-inch pipe connection at this point permits diversion of the raw water into the mixing chamber, which is located adjacent to the mixing flume. The by-passing of this raw water to the influent of the mixing chamber is controlled by means of a 2-inch gate valve.

The chemical solutions for coagulation, etc., are applied to the influent passage of the mixing chamber, which is provided with appropriate over-and-under baffles to cause a thorough mixing of the chemical with the raw water. The coagulation is then carried out by passing the treated water through a series of around-the-end baffles so designed as to give a 30-minute mixing period with a flow velocity of 0.4 ft. per second. This is effected by means of forty-eight 1-inch passes, approximately 12½ feet in length and 10 inches deep, with about a ½ to ¾-inch clearance around the ends of the baffles, giving a total linear travel of 602 feet. The entire mixing chamber is built on a slope of 0.4 ft. per ft. to compensate for the loss of head of the structure—with this arrangement, 79 per cent of the chamber was found to have a linear velocity of 0.3 ft. per second. Two additional connections, valved by 2-inch gate valves, are provided at intermediate points of the mixing chamber, so that, the detention, or mixing period, may be varied from 30 to 20, or even 10 minutes, as may be desired, by the proper manipulation of the three valves.

The last pass of the chamber is fitted with a single over-baffle at the discharge end, which functions as a weir to maintain a constant elevation in the mixing unit. A 2-inch gate valve also controls the discharge from the chamber to the sedimentation basin.

The coagulated water is discharged from the hydraulic-jump mixing flume and the mixing chamber into the stilling box at the influent end of the sedimentation basin. From this stilling box the water passes into a chamber provided with a hanging baffle which distributes the flow into the sedimentation basin proper. This sedimentation basin is 20 feet long, 3 feet 3 inches wide, and 5 feet 2 inches deep, inside dimensions, the size of which was limited by the small available floor space. A 6-inch stilling box, running across the entire width of the basin, is provided at both the influent and effluent ends. A 12-inch hanging baffle is located about 12 inches away from the influent stilling box. The 5-foot wall of the effluent stilling box acts as the overflow weir of the basin, maintaining a 5-foot depth of water. The normal capacity of the basin is 2,500 gallons, providing a nominal detention of 6 hours with a flow of 10,000 gallons per day, and is equivalent to the average detention period obtaining at the Baldwin Filtration Plant.

The settled water is removed from the effluent side of the basin by means of four, equally spaced, 1-inch lines connecting into a common header, to insure uniform decantation over the entire cross-section of the basin. The collecting header is next connected to the four small sand-filters by a series of 1-inch lines, properly valved at the point where the settled water enters the filters.

The basin is provided with a 2-inch drain to permit the removal of the accumulated sludge. Provisions are made for periodic sampling of the sludges. Various piping arrangements permit multiple uses of the basin. Means for the removal of some of the residual effluent floc is afforded by the use of vertical screens (1/16-in. mesh) which function as "floc collectors" at the effluent end. This set-up is intended to be used in connection with a group of experiments on tendency of floc "carry-over"at certain seasons, and its effect on filter runs.

In addition to the above, a 2-inch line some 25 feet in length, is provided to deliver the settled water to the 24-inch tile sand-filter of "Unit A," through a 2-inch gate valve located at the top of the filter. A by-pass drain is also provided for by-passing the water to the waste when the filters are being washed.

The original rapid sand filter of "Unit A" (Fig. 1) is constructed out of 5 sections of 24-inch sewer tile, providing a positive operating head of 11 feet. The filter sand and the construction of the bed are similar to the large scale filters in use at the Baldwin Plant. The sand bed is 30 inches deep, with effective size of 0.40 millimeter and a uniformity coefficient of 1.22. Underlying the sand bed is a gravel layer 22 inches deep and graded in size from 1½ inches at the bottom to 1/16 inch at the top. A special perforated plate forms the underdrain system. The sand bed has a net filtering area of 3.14 sq. ft. and with the normal rate of filtration of 2 gallons per sq. ft. per min., the filter treats 10,000 gallons per day. The rate of filtration is maintained by means of a constant head box, operated by floats connected to a 2-inch butterfly-valve, the flow from which is controlled by a 1-inch gate valve, which discharges the filtered water to waste. Direct reading glass-tube gauges are used for registering the loss of head of the filter during operation. A 4-inch wash-water gutter, constructed in the shape of a cross, is set at a 22-inch free-board to permit high-velocity washing up to a 36-inch vertical rise per minute. A 2½-inch pipe line connected to the center of the cross, discharges the wash water into a sump which overflows into a near-by sewer. The usual piping facilities for back-washing filters are provided.

To permit duplication of filter runs, this portion of the experimental plant was supplemented by installation of four smaller filters, 6-inch diameter, with piping appurtenances for constant head overflow and sewer-waste for back-washing interconnected. Wash-water facilities are also provided for at the effluent lines of the filters. The rate of filtration is maintained constant by means of constant-head boxes, at the filter effluents, from which the standard rate of flow is maintained by means of constant flow siphons, which also provide for an automatic shut-off when the ultimate loss of head of 9.5 feet is reached. The individual filters are equipped with separate loss of head gauges, similar to that of the large filter in "Unit A."

Provision is also made for making parallel runs with experimental filters of both "Unit A" and "Unit B" and the large plant filters for periodic comparison and checking with the full-scale plant conditions. A 1-inch pipe line tapped into the side of one of the large filters reserved for experimental work, delivers the regular plant settled water to the experimental filters through a 1-inch meter. Parallel runs indicate the hydraulic characteristics of the experimental units to be identical with those of the regular plant, and consequently capable of conclusions which apply to the larger units.

Acknowledgment

It is desired to acknowledge the courtesy of the Wallace & Tiernan Co., for the loan of their chlorinators and the experimental Novadel Dry-Feed Machine; to the Omega Machine Co. for the loan of the special dry-feed equipment; and to %Proportioneers% Inc. for the loan of their solution-feed Chlor-O-Feeder.

REFERENCES

1. Studies in Water Purification Processes at Cleveland, Ohio, by W. C. Lawrence. Jour. A.W.W.A., Vol. 23, No. 6.
2. The Ammonia-Chlorine Process as a Means for Taste Prevention and Effective Sterilization, by Mathew M. Braidech. Proceedings, 1929 Ohio Conference on Water Purification. Pre-ammoniation of the Filtered Water Supply of Cleveland, Ohio, by J. W. Ellms. Jour. A.W.W.A., Vol. 23, No. 3. Practical Application of Ammonia-Chlorine Process in Sterilization of the Cleveland Water Supply, by Mathew M. Braidech. Proceedings of the 1930 Ohio Conference on Water Purification.
   The Ammonia-Chlorine Treatment at Cleveland, by W. C. Lawrence. Jour. A.W.W.A., Vol. 23, No. 9, Sept., 1931.
3. Modern Aspects of Water Purification, by E. Sherman Chase. Jour. N.E.W.W.A., Vol. 48, No. 4, Dec., 1934.

EDITORIAL

What the Supreme Court Has Done

ON March 15th the Supreme Court of the United States handed down a 7:2 decision that the operation of water works, owned or operated by a municipality, or other political sub-divisions must be considered an "essential governmental function." This being so, the salaries paid to employes engaged in the operation of such water systems must be held to be exempt from taxation by the Federal government. The decision written by Justice Sutherland was concurred in by seven of the justices, with two (Brandeis and Roberts) rendering a dissenting opinion.

The following are excerpts taken from the majority opinion: "We conclude that the acquisition and distribution of a *supply of water* for the needs of the modern city *involve the exercise of essential governmental functions*, and this conclusion is fortified by a consideration of the public uses to which the water is put."

"It may be, as it is suggested, that private corporations would be able and willing to undertake to provide a supply of water for all purposes; but if the State and City of New York be of opinion, as they evidently are, that the service should not be entrusted to private hands, but should be rendered by the city itself as an appropriate means of discharging its duty to protect the health, safety and lives of its inhabitants, we do not doubt that it may do so in the exercise of its essential governmental functions."

"What the city is engaged in doing in that respect is *rather rendering a service than selling a commodity*.* If that service be governmental it does not become private because a charge is made for it, or a profit realized."

"A Federal tax in respect of the activities of a State or State agency is an imposition by the government upon the activities of another (government), and must accord with the implied Federal requirements that State and local governmental functions be not burdened thereby."

"In the light of these considerations it follows that the question here presented (that of the legality of the Federal government taxing the salary of an employe of the Department of Water Supply of New York City)* is not controlled by local law, but *is a question of national scope* to be resolved in harmony with implied constitutional principles of general application."

At this writing we have not before us the complete decision but the above excerpts were drawn as the more pertinent of the statements the document contained and fairly well tell the story in the space available. Involved in the decision, however, is an analysis which became an important basis for the conclusion that the functions of water supply are primarily governmental. It had to do with the fact that sanitation in the form of sewerage facilities and safe disposal of sewage was of nature, so closely tied in with and dependent upon the availability and dependability of water supply and its operation as to constitute most important consideration. Likewise the functions of water supply in the matter of fire protection and usage in public enterprise proved important considerations. It was on these premises that the operation of the water works of a community must be considered that of "rendering a service" regardless of the fact that the water utility might simultaneously be selling a commodity, at a profit, or otherwise.

*Italics and explanatory statements in parenthesis are ours and not those of the Court.—Ed.

The case in question was that of W. W. Brush vs. U. S. Commissioner of Internal Revenue. It began while Mr. Brush was serving as Chief Engineer of the Department of Water Supply of New York City and has been prosecuted by the State of New York, through the Attorney General's office, and the City of New York, through its able and highly successful Corporation Counsel, Paul Windels and staff, for benefit of the many employes of its Department of Water Supply. Incidentally, as it proved out, additionally for the good of municipal water works operators of the entire nation.

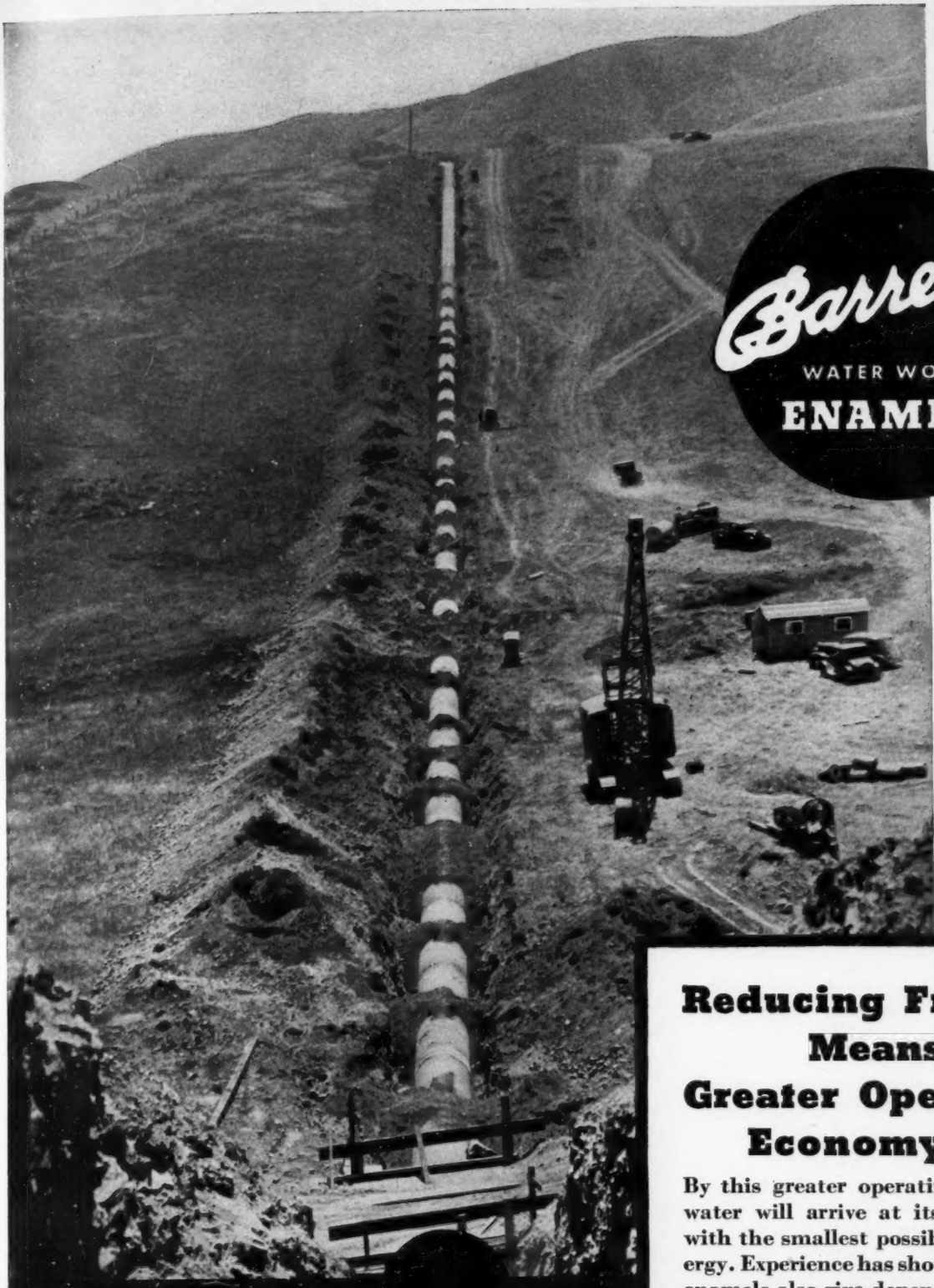
Those operators and managers of water departments who have paid all or any part of their income tax are most likely indeed fortunate. If we understand the Federal Income Tax Bureau correctly these men have a refund due them. Not only will they eventually get back all income tax paid over the several years; but, in addition, they will receive interest on the amounts at the rate of 6 per cent per annum from the date of payment to the date of settlement and actual return of the amount paid in.

Out of this telling decision by the highest Federal tribunal, reversing decisions of two U. S. Circuit Court of Appeals in two districts, the most far reaching effect is that the supplying of water to a community constitutes "an essential governmental function." Furthermore, the supplying of water is primarily the rendering of "a service, rather than the selling of a commodity." What may come about as the ultimate and far-reaching effect of the court's analysis of, its expressed views upon and final decision, so conclusive as a 7:2 decision is considered, remains to be seen in future years. It may have a definite and decisive effect in evaluation cases, in trends toward purchase of privately owned water systems by municipalities, and create a changed basis for settlements of differences between the management of one and officials of the other.

An interesting disclosure in the case is to be found in statistics revealing that of the 49 larger cities in the United States only two (Birmingham and Indianapolis) fail to own their water works systems. In the case of Birmingham it could have been pointed out that the city is now completing, at considerable expense, a municipal industrial water supply system; furthermore, is planning toward purchase of the privately-owned system.

Along with present trends, therein consolidations or joint financing and operation of water works and sewerage is gaining in favor and practice. The fact the Supreme Court considers these two as governmental functions, difficult to separate in all practical consideration and evaluation, has more than passing significance. The soundest management, operation and financing of these two inter-dependent services is patently had in one general department equipped and manned to handle both municipal functions which have so many aspects of parallel nature, requiring operating personnel with knowledge and experience of preponderant similarity.

That the Supreme Court has rendered a valuable and far-reaching service to water works personnel, in its decision that water supply is an essential governmental function, needs no re-stating. Should it rule also that water works and sewerage, being so essential public services that both shall be free from political interference and operated and managed on a purely technical and business basis—then, water and sewerage managers and operators would find themselves in the "promised land."



60" diam. Steel Pipe, City of San Francisco, California

Reducing Friction Means Greater Operating Economy . . .

By this greater operating economy, water will arrive at its destination with the smallest possible loss of energy. Experience has shown that these enamels also give dependable, lasting protection against soil acids and alkalis and prevent tuberculation. The specially processed coal-tar pitch from which they are made is the most stable bituminous material known. Phone, wire or write for full details.

THE BARRETT COMPANY
40 Rector Street New York, N. Y.

FIELD SERVICE . . .

The Barrett Company maintains a Pipe Line Service Department to assist engineers in all coating problems, and also has available Field Service men whose assistance is available where Barrett's protective coatings are used. Inquiries are invited.

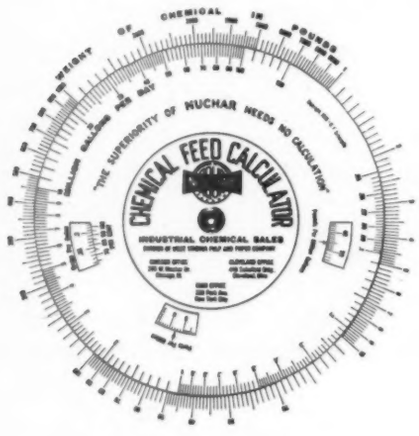
Equipment News

Chemical Feed Calculator

(Offered Free by Nuchar Manufacturers)

The ingenious Chemical Feed Calculator, here pictured, is in principle a circular slide rule which, with a single setting of gallons treated on the revolving center scale opposite pounds of chemical applied, reveals the dosage simultaneously in "pounds per million," "parts per million," and "grains per gallon." These figures appear opposite the arrow of the three different windows cut into the revolving disc to reveal the scales beneath. Conversely, the calculator can be used to determine the pounds of chemical per 24 hours, to be fed for any given rate of flow, to provide the dosage in parts per million or grains per gallon desired. Likewise, with one setting parts per million, grains per gallon or pounds per million can be converted one to another at a glance. On the rear are printed conversion factors considered most useful in water treatment.

This little calculator, which is about the most ingenious and handy device for the water and sewage treatment operator that has come to our attention, is the copy-



Chemical Feed Calculator

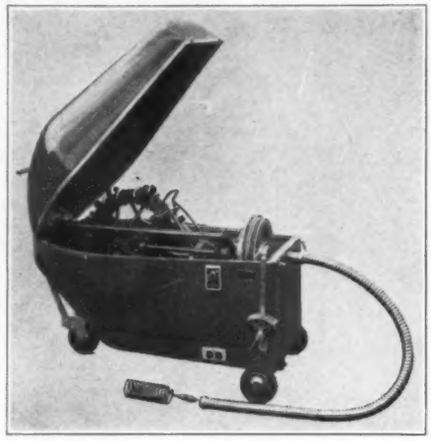
righted invention of O. F. Schoepfle, superintendent of filtration at Sandusky, Ohio.

Industrial Chemical Sales, well known manufacturers of Nuchar Activiated Carbon, who have secured rights from Mr. Schoepfle to manufacture and distribute the calculator, are offering it *without charge* (in the order of application) to any requesting one. Here is a device that everyone concerned with calculating chemical dosage and chemical feed will find useful and appreciate. It's yours for the asking—simply address a request to Industrial Chemical Sales, 230 Park Ave., New York City.

▼

Werko Sewer Sweeps

In the August, 1936, issue of this magazine appeared an article describing sewer cleaning experiences which involved a severe condition remedied with what has since become known as the "Werko" Sewer-Sweep. Since that time the original instrument has been improved and just recently the inventor and manufacturer has announced two new models of the Sweep. The "Werko" Sweep makes use of a reel of 400 ft. of steel wire 3/16 in. in diameter and oil tempered. To its end is attached the desired cleaning tool,



Werko Sewer Sweep

which is inserted into the sewer. As the wire leaves the unwinding reel, which rotates at right angles to its axis as it unwinds, a spiral-like motion is imparted to give a corkscrew boring effect for penetrating stoppages and twisting off root masses. The wire is fed and turned simultaneously by a ¾-hp. motor enclosed with the reel in a case mounted on rubber tired ball-bearing wheels. The complete machine weighs 290 pounds. An automatic clutch allows the speed of wire feed, or its withdrawal, to be varied as desired.

An illustrated folder on the "Werko Electric Sewer Sweep" can be had by addressing George H. Werfelman Company, 1304 E. 6th St., Los Angeles, Calif.

▼

Everson Rota-Meter Chlorinator

The Everson Manufacturing Co. of Chicago, long established manufacturers of water treatment and swimming pool equipment, have just announced a new line of Rota-Meter Chlorinators with capacities from 0.5 to 1,000 pounds per 24 hours.

The feature of the new Everson Chlorinator is the "Rota-Meter" which is visible under the bell-jar in the accompanying picture. The "Rota-Meter" (described on page 59 of our January issue) has been proven as to accuracy in industrial usage for measuring gas flows. It consists of a silver top-shaped rotor which is spun and floated upwards on the gas stream passing through a tapered vertical calibrated glass tube. The faster the gas flow past the rotor the higher the spinning top rises, the rate of flow being read in pounds per day on the etched tube. This method of measuring gas and liquid flow is reputed to be dependably accurate, the Everson Company claiming better than 99 per cent accuracy for chlorine feed.

Other features of the new chlorinator are simplicity and the safety elements such as

De Luxe Vacuum Feed Model

automatic venting, automatic vacuum beaker, double glass case and water sealed bell-jar over the Rota-Meter—all being effectively described in the Everson Rota-Chlorinator bulletin. These chlorinators are offered in two styles, the skeleton and enclosed models, both having a feed ratio of one to ten between minimum and maximum capacities. That pictured is the De Luxe Vacuum Feed Model, the cabinet of which is 24x20 in. in plan. For descriptive bulletin, "Everson Vacuum Feed Rota-Chlorinators," with illustrated design and operation of the chlorinator, address Everson Manufacturing Co., 214 West Huron St., Chicago, Ill.

▼

Useful Flow Powergraph Offered Gratis

On page 256 of the 1936 Reference and Data Issue of WATER WORKS AND SEWERAGE appears a full page reproduction of the highly useful "Flow Powergraph" devised by Arthur T. Clark and M. B. Frost. With it a rapid and accurate determination of power required for pumping various quantities of water through pipe lines of various diameters, lengths and condition can be made. In using this graph no complicated computation from formula is required, and there are no factors to apply other than the known or assumed friction coefficient ("C" value) of the pipe in question.

Aside from the fact that Clark and Frost's "Flow Powergraph" has been highly useful and time saving to engineers studying economic design and evaluation of power requirements, it has proved most helpful to water works managers or operators in checking up, at intervals, on the condition of the interior of mains and detecting such matters as partly closed valves or other obstructions on pumping mains.

Since the printing of our May 1936 Reference and Data Issue the "Flow Powergraph" has been revised, improved and copyrighted by Arthur T. Clark.* National Water Main Cleaning Company has secured the privilege of having it produced on

CLEVELAND comes back for more!

Dresser Couplings are making a hit in Cleveland! Used in 1934 on a 30" water line, Dresser Couplings were called for again on another 30" steel supply line, constructed in 1936. That's the way it is everywhere! Once tried, Dresser Couplings stay on call.

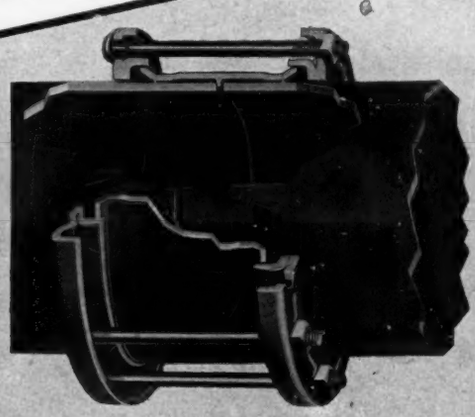
FIVE REASONS WHY MODERN WATER LINES ARE DRESSER-COUPLED:

1. **PERMANENT TIGHTNESS**—proved for 50 years, on 150,000 miles of lines.
2. **FLEXIBILITY**—normal pipe movements—present in every line—absorbed.
3. **SIMPLICITY**—joint parts are "factory-made"; ordinary labor is used.
4. **STRENGTH**—predetermined; joints safely withstand specified pressure.
5. **TRUE ECONOMY**—a lower joint cost throughout the life of the line.

RECENT DRESSER INSTALLATIONS

Ann Arbor, Mich.
Buffalo, N. Y.
Elyria, Ohio
Mansfield, Ohio
Nyack, N. Y.
Sacramento, Calif.

Ordinary workmen completing Dresser joint on Cleveland 30" supply main, built in 1936.



Cutaway view of Dresser Style 38 Coupling, showing working principle. Plain-end pipe is used. The resilient gaskets flexing with the pipe, safely absorb pipe movements.

THE MODERN TREND IS TO DRESSER COUPLINGS

S. R. DRESSER MFG. COMPANY, BRADFORD, PA. • *In Canada:* Dresser Mfg. Company, Ltd., 60 Front St., W., Toronto, Ont.

% CHEMICAL FEEDERS %

"ATTAR OF ABATTOIR!"
RECIPE FOR A "CHLORINE BREAKFAST"
1 JIGGER OF CHLOR-O-TASTE
1 JIGGER OF CHLOR-O-DOR
1 CASE OF VARIABLE WATER FLOW
1 CASE OF CONSTANT RATE CHLORINATION
1 CASE OF OUT-OF-ORDER CHLORINATOR
MAY BE MIXED IN IMMEASURABLE FLAVORS AND SCENTS

"p.p.m." (not "guesses") of chlorine is CHLOR-O-FEEDER'S antidote for non-proportional chlorination

Over or under chlorination inevitably results from constant rate treating of a variable water supply.

Proportional Chlor-O-Feeder, mounted on a standard water meter, feeds a definite amount of hypochlorite solution to every gallon passing the meter —*"p.p.m. and not guesses."*

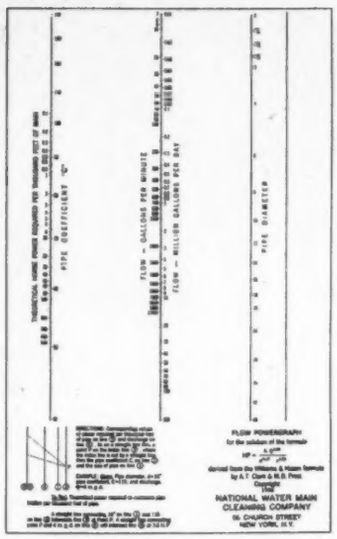
Bulletin "PH" describes and illustrates all designs of Chlor-O-Feeders. For a copy address—

% PROPORTIONEERS % Inc.

Associated with Builders Iron Foundry

9 N. Codding Street

PROVIDENCE, R. I.



Flow Powergraph

sized linen in an 8 x 10 inch size for free distribution. A copy of this useful graph is available for the asking—address, National Water Main Cleaning Co., 50 Church St., New York City.

▼

Allied Scientific Corporation

Recently founded, is Allied Scientific Corporation, composed of leading laboratory supply and scientific equipment companies. The new organization has been designed to make possible a better service to the customers of member firms; to improve their facilities as manufacturers representatives; to, in general, promote the best interests of the laboratory supply industry. The charter member firms are: Burrell Technical Supply Co. (Pittsburgh); Eberbach & Son Co. (Ann Arbor, Mich.); Green Bros., Inc. (Dallas, Tex.); Geo. T. Walker & Co., Inc. (South Minneapolis, Minn.); Cincinnati Scientific Co. (Cincinnati); Phipps and Bird, Inc. (Richmond, Va.).

▼

Fire Underwriters Issue Approval on Transite Pipe

The National Board of Fire Underwriters has issued a report of approval on Transite Pressure Pipe, which covers Johns-Manville "Transite Class 150 pressure pipe and couplings in sizes from 4 to 24 inches, inclusive, for use in underground water service where the working pressure does not exceed 150 lb. per square inch."

The 80-page report states that: "From the conclusions drawn it will be noted that it is practical to handle and ship the pipe and couplings and install and maintain them in underground piping systems; that systems constructed of them are not subject to rapid deterioration; that the pipe and couplings are capable of withstanding all reasonable stresses to which they are likely to be subjected under ordinary service conditions; that they are reliable in service; that they are uniformly made and can be uniformly assembled."

*Former Chief Engineer, Community Water Service Company—lately with Barrett Co., as Engineer of their Pipe Coating Dept.

Air Compressor From Ford Parts

60 cubic feet per minute with one gallon of gasoline per hour!

Operates rock drill, Pavement breaker, digging tools, caulking hammers, backfill tampers, chipping hammers, sand blast, etc.

Widely used by Cities, Counties and Public Utilities because of its low cost, economical operation, ease of handling and Ford service.

Available in portable form or as conversion parts for your own Ford motor.

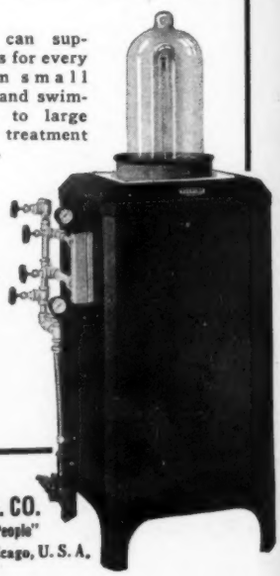
Write for complete literature and prices.

GORDON SMITH & COMPANY
Incorporated
517 Tenth St., Bowling Green, Ky.

Announcing
The New **EVERSON**
Rota-Meter Chlorinators

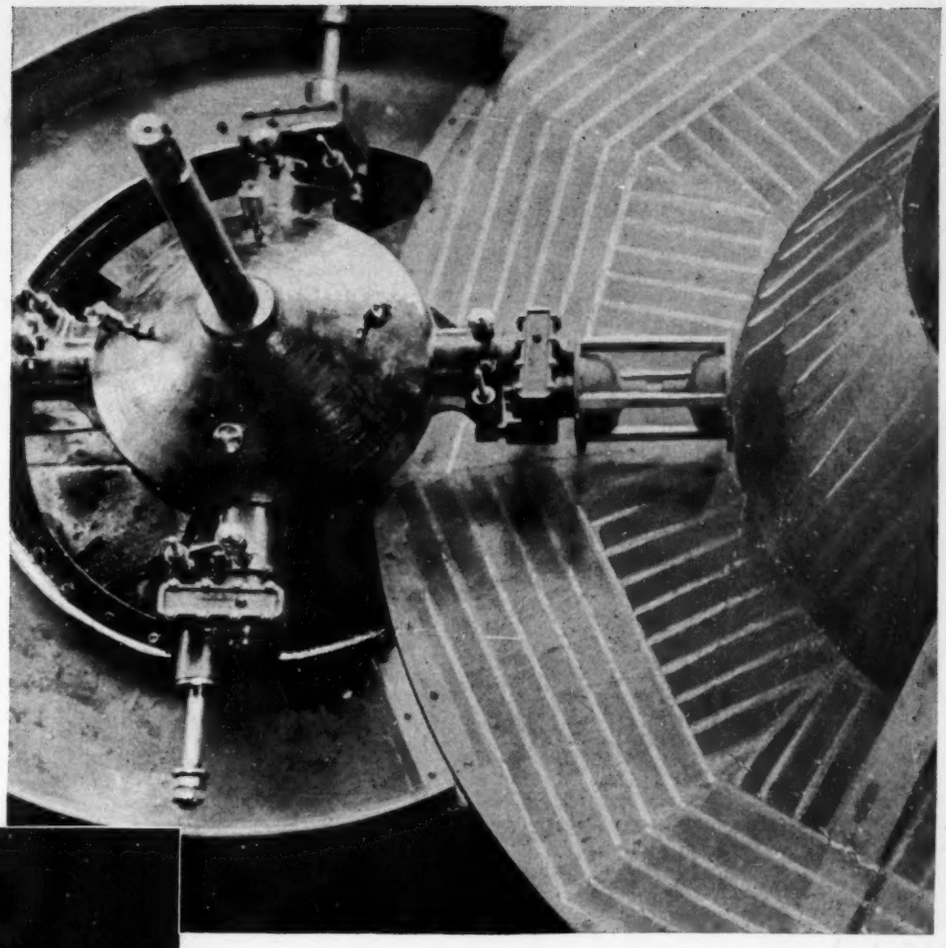
HERE at last is the perfect chlorinator, featuring the exclusive EVERSON *micro-control*, absolutely accurate feature, combined with the other proven EVERSON features including: Automatic Gas Absorber, Automatic Venting, and the Automatic Vacuum Break which protects against Back-Flooding.

EVERSON can supply capacities for every need — from small water works and swimming pools, to large sewage treatment plants.



Write for New Bulletin

EVERSON MFG. CO.
"The Swimming Pool People"
633 W. Lake St., Chicago, U. S. A.



ANACONDA
from mine to consumer

Shop assembly view of 12-foot EVERDUR sewage disc screen with revolving brush mechanism (brush staves not shown). Designed and furnished by Krajewski-Pesant Mfg. Corp., New York City, for the Stafford Springs, Conn., Sewage Treatment Works.

FOR 10 YEARS

EVERDUR* has proved itself in sewage treatment service

Since 1927, for coarse and fine screens, gates, aprons, weirs, and many other sewage treatment applications, Everdur Metal has demonstrated that it has exceptional advantages.

Steel-like strength and high resistance to corrosion are of course of first importance. But in addition, EVERDUR Metal is fabricated so easily, and is so reasonable in cost, that it is acknowledged by many authorities to be in a class by itself for sewage treatment service. EVERDUR is available in all commercial forms. Let us send you complete information. Ask for Publication E-11.

* "Everdur" is a trade-mark of The American Brass Company, registered in U. S. Pat. Off.

37388

RUSTLESS AS COPPER
STRONG AS STEEL

Everdur Metal

THE AMERICAN BRASS COMPANY · General Offices: Waterbury, Connecticut

Offices and Agencies in Principal Cities · In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

CATALOGS AND LITERATURE RECEIVED

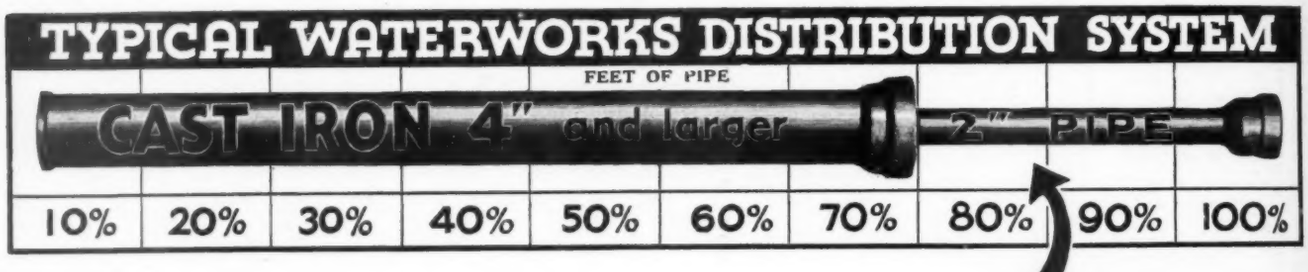
[*Any of the publications reviewed in this secton can be secured from or through Water Works and Sewerage, if such be desirable.*]

"Directory of Consulting Chemists and Chemical Engineers"—From the Association of Consulting Chemists and Chemical Engineers has been received a copy of its revised Directory of Members. The booklet is divided into three parts—(a) The Directory; (b) Statements of the activities of each member or member firm; (c) "Key Sheet," which discloses various types of work specialized in by each member. The booklet is especially designed to assist anyone needful of the services of a chemical laboratory or the chemical engineer; to facilitate selection of those best equipped for the requirements at hand; those most strategically or conveniently located geographically. A copy of "The A.C.E. Directory" is available for the asking. Address, Robert T. Baldwin, Executive Secretary, "A.C.E.," 50 East 41st St., New York City, N. Y.

"Flexibles—the Sewer Cleanout Rods"—Comes from Flexible Sewer-Rod Equipment Company; describes the new flexible steel wire sewer-"rod" and its various adaptations in relieving service line stoppages, removing tuberculation from dead ends, and cleaning sewers, both large and small. The "rod" is made up from 3-ft. sections of resilient wire joined together with stream-lined Rod Couplings. Illustrated are the several cleaning tools, for attaching to the resilient "rod," and methods of using it to twist free the obstruction, root growth, etc. Also pictured and described is the winch and handy power-drive unit, and pipe scrapers of the collapsible type, for use on encrusted sewers and water piping. Some of the work of the "Flexible" compact coiled "rod" and its adaptations are also illustrated and confirmed by testimonial statements from an impressive list of users. Amongst these are water main cleaning experiences. For a copy of "Flexibles," address Flexible Sewer-Rod Equipment Co., 622 East 4th St., Los Angeles, Calif.

"Ferrisul"—Merrimac Chemical Company have just issued a worthy little brochure on the coagulant "Ferrisul," which contains 90 per cent or better anhydrous ferric sulphate. It discusses the "Theory of Coagulation with Iron Salts" and treats in more detail the effectiveness of "Ferrisul" in the removal of manganese, softening, clarification of hard and soft waters, color removal. Under the head, "Sewage and Wastes Treatment," the especial merits of "Ferrisul" in chemical precipitation practices are set forth; several examples of its successful usage being cited, with specific conditions outlined. Properties of "Ferrisul," with its 25.2 per cent or better iron content, are set forth and followed by suggested methods of "Storing, Handling and Using Ferrisul." The last involves the best methods of preparing solutions and feeding. For a copy of "Ferrisul," address Merrimac Chemical Company, Everett Station, Boston, Mass.

"Bailey Meters"—Is a new, informative, and helpfully illustrated 40-page bulletin on "Flow Meters for Liquids and Gases," by Bailey Meter Company. In it



Your BIG mains are *cast iron,* the standard long life, low cost pipe . . . but how about your *small* mains.

McWane *2" cast iron* pipe gives you the same protection against corrosion . . . the same long life . . . the same low cost. For it's made the same way, of good gray iron . . . sand cast inside and outside. High tensile and transverse strengths . . . long lengths easy to cut and tap . . . modern factory-made joints for easy, quick installation with unskilled labor.

Sand Cast Inside and Outside

McWANE
CAST IRON PIPE COMPANY
BIRMINGHAM, ALA. SIZES 1¼" THROUGH 12"

Chicago, Dallas, Denver, Kansas City, New York, Portland Ore., Salt Lake City, San Francisco, Los Angeles.

30%
McWANE 2" CAST IRON PIPE

MAKES THE 30%
• *RUST RESISTING*
• *EVERLASTING*

is a discussion of Primary Elements such as orifices (fixed and adjustable), flow nozzles, Venturi tubes, and the basic considerations and tolerances in installation arrangements of the primary element. Also the proper selection of element and its location for given conditions; approved methods of making meter connections to instruments are discussed and illustrated. Another section illustrates many permissive combinations of indicating, recording and integrating features; another describes and pictures several Bailey flow mechanisms; another, accessories. One section explains the powerful Ledoux-Bell flow-mechanism, which operates to record flow rates without an external power source. Ask for bulletin 301. Address, Bailey Meter Company, Cleveland, Ohio.

"Tow-Bro Sludge Remover"—Is a new Rex Sanitation Equipment Catalog from Chain Belt Company, which describes and illustrates the novel features of the Tow-Bro sludge withdrawal mechanism for clarifiers. Distinctive is the "vacuum-cleaner" principle of the revolving hollow tube arm to which are attached the many vacuum-cleaner shaped take off nozzles which make a sludge "scoop" no sooner than the solids have hit bottom. Features claimed are that a fresher and more concentrated sludge is taken off, with minimum of sludge accumulation in the clarifier; and that an improved effluent and operating economy results. Representative installations are pictured to show details, and a listing of Tow-Bro equipped water and sewage plants (with brief description) is presented. Included is the newer Tow-Bro Sludge Remover for rectangular tanks—also of the suction type. The last several pages reveal operating data from a comparative test run of competing sludge removal mechanisms in actual plant service. Address, Chain Belt Company (Sanitation Divison), 1600 W. Branch, Milwaukee, Wisc.

"Turbine Sewer Cleaning Equipment"—In a new, complete and profusely illustrated catalog, Turbine Sewer Machine Co. (specializing for 25 years in development and production of sewer cleaning equipment) present their full line with a price list appended. From cleaning rods and "bull-dog" pushers to the Turbine Power Cleaner, the catalog covers root-cutters and harpoons, sewer brushes, sand scoops, flushing equipment and the self-propelling Ferret Turbines for which the company is famous. Also there are a series of illustrations to show the method of employing the Turbine system of cleaning. Included is Turco Manhole Cushion for rattling or banging manhole lids—too little known to most municipalities. For a copy of the complete Turbine Catalog 7-A, address Turbine Sewer Machine Co., 5212 West State St., Milwaukee, Wisc.

"Embeco"—Its Action in Concrete and Mortar—From Master Builders Co. comes a 31-page brochure which describes the interesting metallic aggregate Embeco which is added to concrete or cement mortar applied from a cement gun. Its usage prevents shrinkage in concrete which is responsible for a variety of attendant after deficiencies, such as failure to bond effectively, checking and subsequent weather spalling and corrosion ingress. "Save the surface and save all"—applies to concrete as to any other material. This technical presentation tells how "Non-Shrink Embeco" functions to enter into chemical combination and produce, thereby, rapid setting, higher density, a more adhesive (bonding), a less absorptive and "tougher skinned" concrete. For a copy of "Embeco," address, The Master Builders Company, Cleveland, Ohio.

Controlling Float Valve

Altitude Valve

Simplicity of Design, Construction and Operation Feature These Valves

DEPENDABILITY

● Controlling Float Valve is ideal for heaters, vats, tanks, etc. Valve entirely self-contained and operates without water spill. Sensitive in operation and indestructible due to air and water cushioning and heavy bronze mountings. Sizes to 24".

● Altitude Valve assures perfect water-level control in tanks, standpipes and reservoirs. Always function without any water surge or shock due to efficient air and water cushioning. Furnished with automatic, electric and manual control, and for single or double-action service.

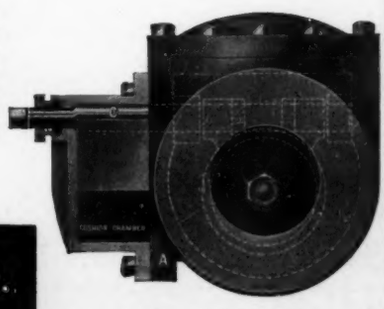
● Float Control Valve for high or low pressure service which can function on any desired water level variation desired. No water hammer or shock due to air and water cushioning. Furnished in angle or globe patterns ½" to 24" sizes in bronze, iron body or steel. No metal contacts assure lifetime service.

● Cushioned Swing Check Valve is nonslam due to perfect cushioning chamber. Minimum friction loss through valve and soon pays in power cost savings. Furnished in all sizes 4" and larger for all service conditions and pressures. Easily equipped with lever for manual control.

Over 30 years' experience is back of these valves.

GOLDEN-ANDERSON VALVE SPEC. CO.
1329 FULTON BLDG.
PITTSBURGH PENNA.

Float Valve


Swing Check Valve

three men dead because of "S-O"

THIS WAS THE TRAGIC RECORD

of one California community's experience with sewer odors—sewer odors caused by Hydrogen Sulphide which formed Sulphuric Acid in the lines and attacked the lime in the concrete until the sewers were *destroyed.* Three deaths, and a costly sewerage investment wiped out!

Both hazards from H_2S can be eliminated by treatment of sewage with Bear Brand Chlorine, and today more than a score of California communities are using Bear Brand Chlorine for this purpose. Chlorination neutralizes H_2S and kills the bacteria, thus preventing generation of the gas. In treatment plants, treatment time is often speeded up, thus increasing efficiency and effecting economies in operation.

For methods of chlorinating, as well as for any other sewage treatment problem, Great Western sanitary engineers are available for consultation without charge.

HYDROGEN SULPHIDE DETECTOR—For communities where extensive and constant testing for Hydrogen Sulphide is necessary, this simple, hand-operated instrument recently perfected by Mine Safety Appliances Company is very valuable. We will be glad to supply descriptive literature on request.

Liquid Chlorine • Ammonia • Ferric Chloride

GREAT WESTERN ELECTRO-CHEMICAL CO.

9 MAIN STREET, SAN FRANCISCO
PLANT: PITTSBURG, CALIFORNIA
4151 BANDINI BLVD., LOS ANGELES

Meetings Scheduled

April 12-14—FAYETTVILLE, ARK. (University of Arkansas).
Arkansas Water and Sewage Conference. Sec'y Dr. Harrison Hale, Dept. of Chemistry, University of Arkansas, Fayettville, Ark.

April 14-16—MONTREAL, CANADA (Windsor Hotel).
Canadian Section, A. W. W. A. Sec'y-Treas., A. E. Berry, Chief Engr., Ontario Dept. of Health, Parliament Bldgs. Toronto, Ont.

April 16—SALEM, N. J. (Salem Country Club).
South Jersey Assn. of Water Superintendents. Regular meeting. Sec'y, Walter Spencer, 2707 Bethel Ave., Merchantsville, N. J.

April 19-22—LEWISTOWN, MONT. (Hotel Burke).
Montana Section, A. W. W. A. Sec'y, H. B. Foote, Chief Engr., State Board of Health, Helena, Mont.
Annual short school preceeds the meeting.)

April 22-23—PHILADELPHIA, PA. (Hotel Bellevue Stratford)
(a) Four States Section A. W. W. A.
(b) Penna. Water Works Operators' Assn.
Joint Meeting.
(a) Sec'y-Treas., Carl A. Hechmer, Washington Suburban San. Distr., Hyattsille, Md.
(b) Sec'y, I. M. Glace, 22 S. 22nd St.,Harrisburg, Pa.

April 23—ST. LOUIS, MO (Broadview Hotel).
Southern & Central Illinois Water Purification Operators' Assn. (Spring Meeting). Sec'y-Treas., Clarence K. Klassen, State Dept. of Health, Springfield, Ill.

April 23-24—STOCKTON, CALIF. (Hotel Clark).
California Sewage Works Association. Sec'y-Treas., R. R. Ribal, 701 City Hall, Oakland, Calif.

April 26—PROVIDENCE, R. I. (Hotel Biltmore).
New England Sewage Works Association. Sec'y, F. W. Gilcreas, Div. of Laboratories, N. Y. State Dept. of Health, Albany, N. Y.

April 29—NEW BRITAIN, CONN. (Hotel Burritt).
New England Water Works Association. (Monthly Spring Meeting.) Sec'y, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.
*(Also May 20th at the Hotel Weldon, Greenfield, Mass.) (This meeting, erroneously listed in our last issue, was scheduled for Boston, Mass., April 18th.)

April 29-30—SPRINGFIELD, ILL. (Abraham Lincoln Hotel).
Illinois Section, A.W.W.A. Sec'y, W. D. Gerber, Engr., State Water Survey, P. O. Box 232, Urbana, Ill.

May 6-7—WILMINGTON, DEL. (Hotel Darling).
Maryland-Delaware Water & Sewerage Assn. (11th Annual Meeting). Sec'y-Treas., A. W. Blohm, 2411 N. Charles St., Baltimore, Md.

May 19—SEATTLE, WASH. (University of Washington Campus).
Pacific Northwest Sewage Works Assn. Sec'y-Treas., Fred Merryfield, Oregon State College, Corvallis, Ore.

May 22-23—VICTORIA, B. C. (Empress Hotel).
Pacific Northwest Section A.W.W.A. Sec'y, Fred Merryfield, Prof. of C. E., Oregon State College, Corvallis, Ore.

June 4-5—UTICA, N. Y. (Hotel Martin).
N. Y. State Sewage Works Asssociation. Sec'y.-Treas., A. S. Bedell, State Dept. Health, Albany, N. Y. (Manufacturers' exhibits a feature of this meeting).

June 7-11—BUFFALO, N. Y. (Hotel Statler).
American Water Works Association. (Annual Convention). Executive Secretary, Harry E. Jordan, 29 West 39th St., New York City.

June 21-25—STATE COLLEGE, PA. (Penna. State College).
Pennsylvania Sewage Works Association (June 21-23). Sec'y, L. D. Matter, State Dept. Health, Wilkes-Barre, Pa.
Pennsylvania Water Works Operators' Assn. (June 23-25). (10th anniversary). Sec'y, I. M. Glace, 22 S. 22nd St., Harrisburg, Pa.

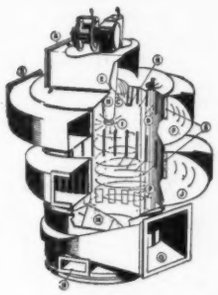
Aug. 18-20—DEARBORN, MICH. (Dearborn Inn).
Central States Section, A.W.W.A. (Annual Meeting). Secy-Treas., H. Lloyd Nelson, 2437 Koppers Bldg., Pittsburgh, Pa.

Sept. 20-22—SANTA FE, N. M. (LaFonda Hotel).
Rocky Mountain Section, A.W.W.A. (Annual Meeting). Sec'y-Treas., B. V. Howe, State Sanitary Engineer, State Office Bldg., Denver, Colo.

Oct. 5-8—NEW YORK CITY, N. Y. (Hotel Pennsylvania).
American Public Health Association. (Annual Convention). Executive Secretary, Dr. Reginal D. Atwater, 50 W. 50th St., New York City.

Oct. 11-14—AUSTIN, TEXAS.
Southwest Section, A.W.W.A. (Annual Meeting). Sec'y-Treas., L. A. Quigley, Superintendent Water Dept., Fort Worth, Texas.

New UNIT Spray Drying and REACTION CHAMBERS



SIZES 5 and 10
For detailed explanation send for Bulletin No. 3.
PATENT ALLOWED AND PENDING

BOWEN

RESEARCH CORPORATION
GARWOOD, NEW JERSEY

BOWEN

INFILCO **DRY CHEMICAL FEEDER - Type D**

Built to meet the exacting requirements of the water purification field. Rugged construction of Type D Feeders insures accuracy, dependability and continuous operation.

Requires no attention except to keep filled. Compact design requires minimum floor space and head room. Fully enclosed construction provides clean and dustless operation.

Write for Bulletin 205

INTERNATIONAL FILTER CO.
59 E. Van Buren Street, Chicago

"JOHN, YOU MUST TAKE THAT OFFER. I CAN'T STAND THE HARD WATER IN THIS TOWN!"

FACE THE FACTS...

Do people like your town?

● Only weaklings stay in a town they don't like. The strongest and best . . . the kind of citizens you need most . . . drift away.

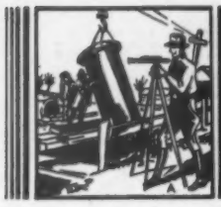
Hard water has driven many people from many communities. And not only people, but industries. Many production processes require water of high quality. Your local industries that are dependent on such processes may move away. And it is all so unnecessary.

Permutit municipal water softening equipment can be installed to make your entire water supply soft. Permutit engineers will cooperate with you and your consultants to handle the job efficiently and economically. They will plan and supply the equipment, train your operating force, periodically inspect the equipment, check results, make corrections as required, and furnish all necessary service.

Start something. Talk it up. You will find that a municipal water softening plant will enlist powerful support . . . especially since soft water economies will save money for your fellow citizens.

Get all the facts first. Write The Permutit Company, Dept. G1, 330 West 42nd Street, New York, N. Y.

Permutit
Water Conditioning



Consulting Engineers

Specializing in the field of

WATER WORKS & SEWERAGE

Albright & Friel, Inc.

Engineers

Chester E. Albright — Francis S. Friel
Water Supply and Purification
Sewerage and Sewage Disposal
Industrial Waste and Refuse Disposal
Investigations — Valuations — Reports

1520 Locust Street
Philadelphia, Penna.

John W. Alvord
Charles B. Burdick
Louis R. Howson
Donald H. Maxwell

Alvord, Burdick & Howson

Engineers

Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation

Civic Opera Building — Chicago

Barstow & LeFeber, Inc.

Municipal—CONSULTING ENGINEERS—Industrial

Water Supply and Purification, Sewerage, Sewage and Trade Waste Treatment, Valuations, Rates, Management, Chemical and Biological Laboratories.

E. D. Barstow — Alfred LeFeber
Associate Engineers
H. H. Mace — L. F. Converse — Wm. H. Carr

American Bldg., Cincinnati, Ohio — Mendenhall Bldg., Akron, Ohio

---

Black & Veatch

CONSULTING ENGINEERS

4706 Broadway, Kansas City, Mo.

Sewerage, Sewage Disposal, Water Supply, Water Purification, Electric Lighting, Power Plants, Valuations, Special Investigations, Reports and Laboratory Service

E. B. Black — N. T. Veatch, Jr.
A. P. Learned — H. F. Lutz
F. M. Veatch — E. H. Dunmire
E. L. Filby

Burns & McDonnell

Engineering Co.

McDONNELL-SMITH-BALDWIN-TIMANUS-McDONNELL

Consulting Engineers Since 1897

Waterworks, Light and Power, Sewerage, Reports, Designs, Appraisals, Rate Investigations

Kansas City, Mo., 107 West Linwood Blvd.
Cincinnati, Ohio, 307 East Fourth St.
Albany, N. Y., 11 North Pearl St.

Chester, Campbell, Davis & Bankson

The Chester Engineers

Water Supply and Purification, Sewerage and Sewage Treatment, Power Development and Applications

Investigations, Appraisals, Rates, Testimony, Design, Supervision, Operation, Accounting

130 Seventh Street, Pittsburgh, Pa.

Fuller & McClintock

Engineers

F. G. Cunningham
Elmer G. Manahan — Ernest W. Whitlock
H. K. Gatley

Sewage Treatment, Sewers, Waterworks, Purification, Drainage, Waste Disposal, Valuations

11 PARK PLACE — NEW YORK

Gascoigne & Associates

Consulting Sanitary Engineers

G. B. Gascoigne — A. A Burger
W. L. Havens — F. W. Jones
C. A. Emerson, Jr. — F C. Tolles

Water, Sewage, Garbage and Industrial Waste Problems — Valuations and Rate Investigations

CLEVELAND, Leader Bldg. — NEW YORK, Woolworth Bldg.

Greeley & Hansen

Hydraulic and Sanitary Engineers

Investigations and Reports. Plans and Specifications. Supervision of Construction. Supervision of Operation. Water Supply and Purification, Sewerage and Sewage Disposal, Garbage Collection and Disposal, Appraisals

6 N. Michigan Avenue, Chicago, Ill.

Nicholas S. Hill Associates

Consulting Engineers

Water Supply, Sewage Disposal, Hydraulic Developments, Reports, Investigations, Valuations, Rates, Design Construction, Operation, Management, Chemical and Biological Laboratories.

112 East 19th St.
New York

Morris Knowles, Inc.

Engineers

Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.

Pittsburgh, Pa.

Metcalf & Eddy

Engineers

Water, Sewage, Drainage, Refuse and Industrial Wastes Problems, Laboratory, Valuations.

Statler Bldg., Boston

Nussbaumer & Clarke, Inc.

Newell L. Nussbaumer — Irving Clarke
Z. B. Phelps, Jr.

Water Supply & Purification
Sewerage & Sewage Disposal
Garbage Incineration

327 Franklin St., Buffalo, N. Y. — 69 Henry St., Binghamton, N. Y.

Malcolm Pirnie

Engineers

Water Supply, Treatment, Sewerage Reports, Plans, Estimates.

Supervision and Operation.
Valuation and Rates.

25 W. 43rd St., New York, N. Y.

Potter, Alexander, C. E.

Hydraulic Engineer and Sanitary Expert

Sewerage and Sewage Disposal, Water Supply and Purification.

50 Church St., New York

Thomas M. Riddick

Consulting Chemist

Municipal and Industrial Water Purification, Sewage Treatment, Operating Supervision of Plants, Sanitary Surveys, Stream Pollution Investigation, Swimming Pool Control. Chemical and Bacteriological Analyses, Testing of Materials.

369 East 149th Street, New York City
(Tel.: Melrose 5-6579)

Russell & Axon

Consulting Engineers, Inc.

Geo. S. Russell—John C. Pritchard
E. T. Jones

Sewerage, Sewage Disposal, Water Works, Filtration, Softening, Power Plants

4903 Delmar Blvd. — St. Louis, Mo.

Whitman & Howard

Harry W. Clark

Associate Engineers (Est. 1869—Inc. 1924)
Channing Howard — Paul F. Howard
Walter A. Janvrin — C. Roger Pearson

Water Supply, Water Purification, Sewerage, Sewage Disposal, Water Front Improvements and all Municipal and Industrial Development Problems, Investigations, Reports, Designs, Supervision, Valuations.

89 Broad St., Boston, Mass.

CALL on LUDLOW

for Motor Operated Valves

Ludlow motor operated valves offer dependable, positive performances—save time and labor—insure protection.

A specialty of the complete Ludlow line, these valves are available in sizes and types for either single or multiple station remote control installation.

Rely on Ludlow valves for fine design—carefully selected materials. Complete information on request.

The LUDLOW VALVE MFG. CO.
TROY · · · NEW YORK

DAYS *can be* **Saved . .**

in laying **BELL** *and* **SPIGOT MAIN**

. . . by using *Tegul*-MINERALEAD for jointing ● Less leakage from the start ● Trenches can be backfilled immediately ● Traffic hazards are cleared up ● *Tegul*-MINERALEAD is tougher than lead ● Offers much higher resistance to vibration and mechanical impact ● Makes permanently tight, trouble-free joints ● Requires no skilled labor ● The ingot form is impervious to rain, snow, flood ● No caulking required ● The ATLAS MINERAL PRODUCTS Company of Penna., Mertztown, Pa.

A Tegul PRODUCT

Tegul-MINERALEAD

pH

MODERN pH and CHLORINE CONTROL

CHLORINE and PHOSPHATE CONTROL

A 54-page handbook containing a simple explanation of pH control and its practical application to numerous problems. The applications of chlorine are also discussed.

It also contains complete descriptions, with methods of operation, of our equipment for colorimetric pH, chlorine and phosphate control; also **Coleman Glass Electrode.**

Copy sent free on request.

W. A. TAYLOR & CO., INC.

872 Linden Ave. Baltimore, Md.

Water Control Equipment

You will be interested in the complete line offered by MUELLER. Write for catalogs of the equipment in which you are interested.

MUELLER CO. . . Decatur, Ill.

Factories: Decatur, Ill.; Chattanooga, Tenn.; Los Angeles, Calif.; Sarnia, Ont.

Branches: New York and San Francisco

Copperas . . .

(FERROUS SULPHATE)

. . . FOR WATER & SEWAGE TREATMENT

(The Base For Chlorinated Copperas)

We invite your inquiries

FAESY & BESTHOFF, INC.

22 E. 40th St. New York

CAN WE HELP YOU?

On other pages in this issue you will find described new and improved equipment, etc., as well as reviews of recent trade literature received by us. By requesting the literature described you will be able to keep your catalog file complete and up to date.

To our readers desiring additional help or information we will be glad to assist you in securing more complete information or data on any equipment or product you need. Use the convenient blank below—no cost or obligation.

WATER WORKS & SEWERAGE, 155 East 44th Street, New York, N. Y.
Gentlemen:—We are interested in the following items and would appreciate your assistance in securing more complete information.

....

....

..... **NAME** .....

..... **POSITION** .....

..... **ADDRESS** .....

April

THERE IS ALWAYS
One Outstanding Leader

To be recognized as a leader is a compliment to ability. It may be the gray goose who leads his flock southward—the thoroughbred that wins the derby—or an organization that stands foremost in its field. In well drilling and pump engineering, Layne has long been the leader:—a world-wide organization with every modern facility, and a proven record of success in doing the job with speed, efficiency and satisfaction.

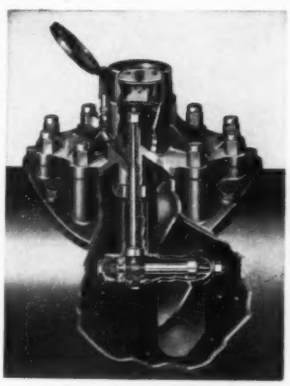
Municipal and Industrial executives may obtain interesting literature by writing Layne and Bowler, Inc., Dept. D, Memphis, Tennessee.

AFFILIATED COMPANIES

LAYNE-ARKANSAS CO. . STUTTGART, ARK.
LAYNE-ATLANTIC CO. . . . NORFOLK, VA.
LAYNE-CENTRAL CO. . . . MEMPHIS, TENN.
LAYNE-NORTHERN CO., MISHAWAKA, IND.
LAYNE-LOUISIANA CO., LAKE CHARLES, LA.
LAYNE-NEW YORK CO. . . NEW YORK CITY.
LAYNE-NORTHWEST CO., MILWAUKEE, WIS.
LAYNE-OHIO CO, ... COLUMBUS, OHIO.
LAYNE-TEXAS CO. . . . HOUSTON, TEXAS.
LAYNE-WESTERN CO. . KANSAS CITY, MO. CHICAGO, ILL., AND MINNEAPOLIS, MINN.
LAYNE-BOWLER NEW ENGLAND COMPANY, BOSTON . . . . . MASSACHUSETTS.
INTERNATIONAL WATER SUPPLY, LTD., FORT ERIE, N. . . . ONTARIO, CANADA.

LAYNE PUMPS
LAYNE WELL WATER SYSTEMS

70,000,000 GALLONS IS A LOT OF WATER



Yet measuring that quantity is merely a day's task for a sixty-inch SPARLING Main-Line Meter. And it's built to stay on the job year after year with little attention or expense. Accurate, easily installed, economical.

SPARLING Meters are made in all sizes from two inches up, to fit the needs of any city or industrial plant from the smallest to the largest.

Combined with SPARLING Recorders and Rate Indicators, they furnish permanent records of hourly, daily and weekly production and distribution, peak and minimum loads, and other important data from which to determine operating costs.

Bulletin 304 will be mailed at your request.

Put your water system on a sound business basis with SPARLING EQUIPMENT.

P. W. SPARLING
WATER MEASURING EQUIPMENT
945-951 N. Main St., Los Angeles
NEW YORK CINCINNATI
CHICAGO

SPEED CONTROL
At Work in Sewage Plants

Conveying feeder at Perth Amboy plant automatically REEVES-regulated. Through this control the exact amount of chemicals is fed to raw sewage proportionate to the number of gallons per minute of flow.

REEVES Variable Speed Transmission—vertical enclosed design—regulating speed of two filters at City of Dearborn, Mich. Provides any desired rate from 2 to 8 minutes, as moisture content of the sludge changes.

REEVES Speed Control units provide infinitely adjustable speeds, between pre-determined limits, on any machines they regulate. Speed changes are effected smoothly—without steps or jumps—while machines are operating. The correct speed is instantly available to compensate accurately for the many variables encountered in sewage disposal processes. Many different methods of control, including sensitive automatic control to maintain perfect synchronization of speeds between processes. Send for FREE copy of 112-page Speed Control Handbook S-37. REEVES PULLEY COMPANY, Columbus, Indiana.

★ MODERN
★ ACCURATE
★ TIME-TESTED

REEVES SPEED CONTROL

FRED STUART *says . . .*

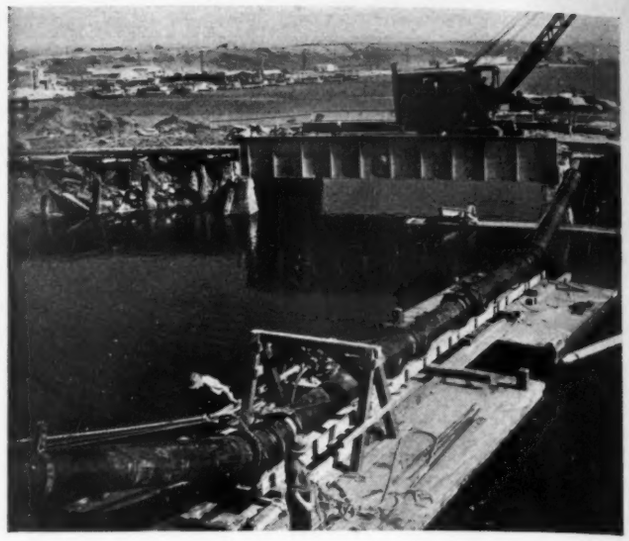
"Four more plants just switched to ACTIVATED ALUM (BLACK ALUM). "

Why?

Activated Alum Corp.

OFFICE:
80 BROAD STREET
NEW YORK CITY

WORKS:
CURTIS BAY
BALTIMORE, MARYLAND



Mono-Cast Doublex Simplex Centrifugal C.I. Pipe

MAKING a submerged channel crossing with 20" Mono-Cast Doublex Simplex Pipe in a water supply line which had to be re-located when new highway construction eliminated an old bridge crossing near Newport Beach, Cal. The pipe was assembled above water, floated into position on barges, then lowered into place on piling 14 ft. below low tide. Mono-Cast Doublex Simplex Pipe is the construction man's best friend. For literature address—

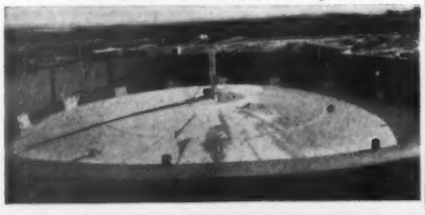
AMERICAN CAST IRON PIPE CO.
BIRMINGHAM, ALABAMA

GENERAL STEEL PLATE CONSTRUCTION
★
GRAVER
TANKS
WATER CONDITIONING EQUIPMENT

Outstanding

The name GRAVER on any tank or metal structure is a mark of real quality. For three-quarters of a century the Graver Organization has served American municipalities through their expert designing, fabricating and erection service.

Send for Literature Today



CONSULT GRAVER WHEN IN NEED OF
Water Filters for mineral, taste, color and odor removal
Settlers
Chlorinators
Lime and Soda Softeners
Zeolite Softeners
Iron Removal Plants
Sterilizers

GRAVER TANK & MFG. CO., INC.
75 Years of Dependable Service
New York, N.Y. East Chicago, Ind. Chicago, Ill. Catasauqua, Pa.

DISTINGUISHED

Modern in every department of its service, yet never unmindful of the fine traditions that have made it One of the Few Famous Hotels in America . . . Rates begin at $5.50

BELLEVUE STRATFORD
CLAUDE H. BENNETT, General Manager
PHILADELPHIA

ANTHRAFILT

INCREASES FILTERING CAPACITY

without plant expansion

●

Experience has shown that the filtration rate of 125 m.g.a.d. cannot be greatly exceeded with sand if a satisfactory effluent is to be obtained.

This rate, however, is increased to 204 m.g.a.d. with Anthrafilt due to its lower specific gravity, which results in less packing in the filters. The shape of the coal grains also gives a larger percentage of voids than does filter sand of the same size.

Detailed cases in which filters equipped with Anthrafilt have increased capacity without plant expansion can be had upon request. Write to . . .

●

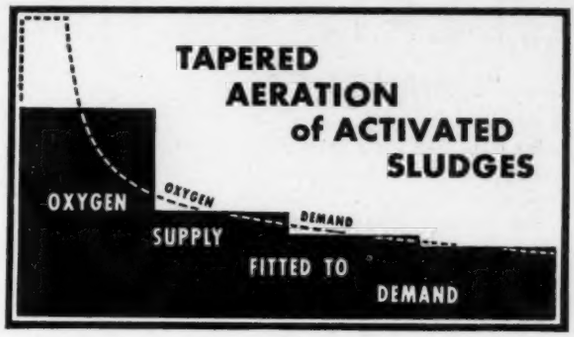
THE HUDSON COAL CO.

SCRANTON, PENNA.

G. B. Fillmore
General Sales Agent

LACKAWANNA "the D&H" ANTHRACITE

H. H. Shaver
Asst. Gen. Sales Agent



With "CHICAGO" AERATION EQUIPMENT

Ask for Complete Information

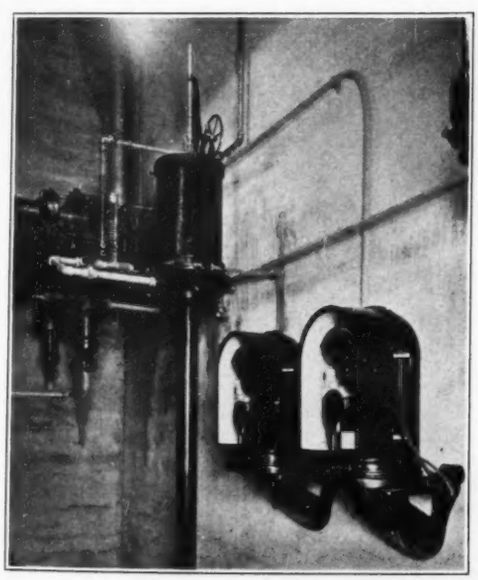
SEWAGE EQUIPMENT DIVISION

CHICAGO PUMP COMPANY

VACUUM—CONDENSATION—CIRCULATING—BILGE
FIRE — HOUSE — SEWAGE — SCRU-PELLER PUMPS
AERATORS — COMMINUTORS — SAMPLERS

2349 Wolfram St. Chicago, Ill.

THE SIMPLEX EGG-SHAPED Flume Meter



Two Simplex 12x8" Egg-Shaped Flumes and Meters at Hatboro-Upper Moreland Sewage Works, Hatboro, Pa.

A rated primary device capable of measuring sewage flows with extreme accuracies over wide flow ranges.

Designed for installation on .005 grades, the instrument's response will be within plus or minus 2% over a range of from 100 to 1.

Let SIMPLEX ENGINEERS help you with your metering problems.

SIMPLEX VALVE & METER CO.

6743 UPLAND STREET • PHILADELPHIA, PA.

ROBERTS FILTERS

"STANDARD OF QUALITY"

For more than thirty years we have specialized in the art of water purification. We manufacture a full line of water filters, both pressure and gravity type; Zeolite water softeners; swimming pool recirculating equipment; and various forms of water rectification units. Inquiries are invited on all problems of water treatment.

ROBERTS FILTER MANUFACTURING CO.

607 COLUMBIA AVE. DARBY, PA.

HELLIGE GLASS ELECTRODE pH-METER

The ideal outfit for use with all electrode systems. Direct reading from 0 to 14 pH. Rugged—extremely simple to use — attractively priced.

Be sure to write for detailed information.

HELLIGE, INC. 3718 NORTHERN BLVD. LONG ISLAND CITY. N.Y.

HEADQUARTERS FOR COLOR STANDARDS AND COLORIMETRIC APPARATUS

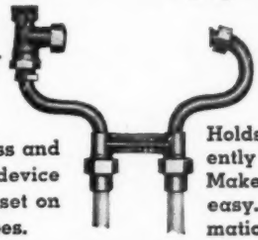
Pressure : Sewer : Culvert : Subaqueous.

LOCK JOINT REINFORCED CONCRETE PIPE

LOCK JOINT PIPE CO. Est. 1905. Ampere, N. J.

The Series 80 Coppersetter

Made both with and without valves. ★



Sizes for 5/8", 3/4" and 1" meters. ★

A simple, all brass and copper holding device for water meters set on vertical riser pipes.

Holds risers permanently connected in line. Makes meter changes easy. Write for information.

THE FORD METER BOX CO.

WABASH, INDIANA, U. S. A.

SETTING AND TESTING EQUIPMENT FOR WATER METERS

Service Boxes | Our Line Is Complete | Send For Bulletins and Prices Modern Iron Works Quincy, Illinois | Our Prices Are Right | Meter Box Covers

WANTED

DRAFTSMAN — Experienced in design work, water supply engineering. Address Draftsman, Box WB, Water Works & Sewerage, 400 W. Madison St., Chicago, Ill.

POSITIONS WANTED

This department has been started as a service to those in the Water Works and Sewerage Fields. We hope they will make use of it. The notices are inserted without charge.

SANITARY ENGINEER—Would like position as operator or chemist of water purification or sewage treatment plant or in design or research. I am a Jun. Am. Soc. C. E. with a B. S. from Yale in Civil Eng. and an M. S. from Harvard in San. Eng., 24 years old, single, Christian, and a hard worker. Have a good background of Sanitary Chemistry, bacteriology; design, and operation of sewerage systems, disposal plants, and water works. I can supply excellent references, and be available in a week's time. Address E. A. T., care Water Works and Sewerage, 400 W. Madison St., Chicago, Ill.

ENGINEER—Licensed N. Y. and N. J., over 20 years' experience, municipal and construction; accustomed to managerial, supervisory and promotion work. Rated by former employers as resourceful, initiative, cooperative and dependable; has had repeat jobs. B. M., 1234 Taylor Ave., Bronx, N. Y.

MUNICIPAL ENGINEER, and public works director, age 34, thirteen years with Ithaca, New York, population 21,000; desires responsible administrative position, as City Manager, Engineer or Public Works Director, or job in industry where administrative training will be of value. Have designed improvements to, and superintended operation of, sewerage and water works system.

Harry W. Eustance, 321 Columbia St., Ithaca, New York.

SANITARY ENGINEER-CHEMIST, B. S. in Chemical Engineering, graduate work in Sanitary Engineering. Age 30. Single. Three years in sewage research. Six years in water purification. At present employed. Desires position with opportunity either in the Water or Sewage Treatment Field, preferably the latter. C. S. N., % Water Works & Sewerage, 155 East 44th Street, New York City.

GAS OR DIESEL ENGINEER—38 years old, married. 20 years' experience in the operation and repairing of gas and Diesel engines. Capable of doing expert repair work on any make of Gas or Diesel engine. Have had experience as erecting engineer. Want position with large company as a service engineer, or as chief engineer in a large plant. Can give references that will be satisfactory to any company. Address R. D. D., care of Water Works and Sewerage, 400 W. Madison St., Chicago.

CHEMICAL ENGINEERING GRADUATE from well known university with six years' experience in water purification, laboratory control tests, distribution system and office procedures. Desires a position as supt. in a small plant or chemist in charge of purification in a large one. Age 29, married, can give excellent references. Box A. F., Water Works and Sewerage, 400 W. Madison St., Chicago.

SANITARY ENGINEER—Graduate University of Illinois, 1929. Desires connection in any phase of water or sewage work. Miscellaneous experience in municipal engineering, steel and concrete design and even commanding a C.C.C. camp. Have good record, initiative, am capable and work hard. Married and will locate anywhere for steady or permanent work. M. B. F., 400 W. Madison St., Chicago.

Determine Alum Floc Formation With the Phipps & Bird Laboratory Mixer

Because: **It is designed after the best practice used in agitators to produce the most effective flocculating action. The speed of paddle may be varied. Samples may be placed and removed while tests are being made. Drive is by chain and sprocket, insuring constant speed of each paddle. The paddle speed is read directly from the tachometer.**

Four standard units are available: All units are 9 in. in width, 12 in. in height and the 3-stirrer unit is 28 in. in length. Each additional unit—add 6 in. to length. The size of the paddle is 3 in. by 1 in. of 20 B&S gauge steel.

PHIPPS & BIRD, INC.

915 E. Cary Street — *Specialists in Water Works Equipment* — Richmond, Va.

THE **NATIONAL METHOD OF WATER MAIN CLEANING**

30 YEARS EXPERIENCE — **WRITE FOR OUR BOOKLET**

NATIONAL WATER MAIN CLEANING CO.
50 CHURCH ST. NEW YORK

Use P F T Equipment in Your Sewage Treatment Plant

Write for Latest Bulletins

PACIFIC FLUSH TANK COMPANY
Designers & Manufacturers of Sewerage and Sewage Treatment Equipment
EXCLUSIVELY SINCE 1893
4241 Ravenswood Ave. Chicago, Ill.
441 Lexington Ave. New York, N. Y.

Arrowhead Grating & Treads

Engineers' Handbook sent on request.

ARROWHEAD IRON WORKS, Inc.
431 W. 5th St., Kansas City, Mo.

STREET, SEWER AND WATER CASTINGS

Made of wear-resisting chilled iron in various styles, sizes and weights.

Write for Catalog and Prices

SOUTH BEND FOUNDRY CO.
Gray Iron and Semi-Steel Castings SOUTH BEND, INDIANA

EDSON'S NEW HAND PUMP

Smallest Diaphram Pump Made. 2" Suction Open Discharge. Capacity 1400 G.P.H. Weight 50 lbs.

THE EDSON CORP'N, 49 "D" Street So. Boston, Mass.

NEW YORK: 142 Ashland Pl., Brooklyn
CHICAGO: 1064 Peoples Gas Building

Catalog "T" Gives Full Data, Also Edson Hand and Power Pumps, Suction Hose and Pump Accessories

---

Use **LAMOTTE EQUIPMENT** *for*
pH Control—Residual Chlorine Control
Boiler Feed Water Control

LAMOTTE CHEMICAL PRODUCTS CO.
442 Light Street, Baltimore, Md.

This man is pouring

SERVICISED PIPE JOINTING COMPOUND

FOR BELL AND SPIGOT SEWER PIPE

It's a wise man who uses SERVICISED Pipe Jointing Compound for SERVICISED produces a joint that is tight, flexible, economical, absolutely waterproof, impervious to weather or soil conditions and prevents root growth or other infiltration problems.

Simple to heat and apply, SERVICISED Compound can be applied by odinary laborers. Further information on request.

© 1920

Asphalt Plank
Expansion Joint
Waterproofings
Asphalts
Fibre Plaster
Sheet Asphalt Waterproofing
For Sewer Tunnels

Write us about our SEWER PIPE BELT

SERVICISED PRODUCTS CORP.
6051 West 65th St. CHICAGO, ILL.

ADVERTISERS

The Dash (—) Denotes Current Advertisers Who Do Not Appear in This Issue.

A

Activated Alum Corp. 76
Albright & Friel, Inc. 72
Alvord, Burdick & Howson. 72
American Brass Co., The. 67
American Cast Iron Pipe Co. 76
*American Gas Products Corp. —
American Hammered Piston Ring Div. of Koppers Co. 13
American Radiator Co. 15
Anaconda Copper & Brass. 67
Armco Culvert Mfgrs. Asso. —
Arrowhead Iron Works. 79
Atlas Mineral Products Co. of Pennsylvania, The. 74

B

Badger Meter Mfg. Co. —
Barrett Company, The. 63
Barstow & Le Feber, Inc. 72
Bartlett Hayward Div. of Koppers Co. 13
Bellevue-Stratford Hotel 76
Black & Veatch. 72
Bowen Research Corporation. 71
Builders Iron Foundry. 73
Burns & McDonnell Engr. Co. 72

C

*Carborundum Company, The. 20
Cast Iron Pipe Research Assoc., The. 24
Chain Belt Company. 12
Chester Engrs., The. 72
*Chicago Bridge & Iron Co. 9
Chicago Pump Company. 77
Chicago Rawhide Mfg. Co. —
Clark Controller Co., The. —
Columbia Alkali Corp., The. 18
Columbian Iron Works. 74
Cooper-Bessemer Corp. —
Corning Glass Works. —
Crane Co. —

D

*Dorr Company, The. Third Cover
Dresser Mfg. Company, S. R. 65

E

*Economy Pumping Mach. Co. —
*Edson Corporation, The. 79
Electro Bleaching Gas Co. 11
Engineering & Construction Div. of Koppers Co. 13
Everson Mfg. Co. 66

F

Faesy & Besthoff, Inc. 74
*Filtration Equipment Corp. —
Ford Meter Box Co. 78
Fuller & McClintock. 72
*Fuller Company —

G

Gascoigne & Associates. 72
*Golden-Anderson Valve Specialty Co. 69
Graver Tank & Mfg. Co., Inc. 76
Great Western Electro-Chemical Co. 70
Greeley & Hansen. 72
*Gruendler Crusher & Pulverizer Co. —

H

Hellige, Inc. 78
Hiler Engr. & Const. Co. 13
Hill Associates, Nicholas S. 72
Hills-McCanna Co. —
Hudson Coal Co., The. 77

I

*Industrial Chemical Sales. 4
*Interol Company, Inc. —
*International Filter Co. 71

K

Knowles, Inc., Morris. 72
Koppers Coal Co. 13
Koppers Company 13

L

La Motte Chemical Products Co. —
Layne & Bowler, Inc. 75
Limestone Products Corp. —
Link-Belt Co. —
Lock Joint Pipe Co. 78
Ludlow Valve Mfg. Co., The. 73
Lynchburg Foundry Company —

M

Maryland Drydock Co. —
Master Builders Co., The. 17
Mathieson Alkali Works, Inc., The. 16
McWane Cast Iron Pipe Co. 68
Metcalf & Eddy. 72
Modern Iron Works. 78
Monsanto Chemical Company. —
Mueller Co. 74

N

*National Water Main Cleaning Co. 79
Nichols Engineering Research Corp. —
Norton Company 10
Nussbaumer & Clarke, Inc. 72

P

Pacific Flush Tank Co. 79
*Pennsylvania Salt Mfg. Co. 6
*Permutit Company, The. 71
*Phipps & Bird, Inc. 79
Pirnie, Malcolm 72
*Pittsburgh Des Moines Steel Co. 5
Pittsburgh-Equitable Meter Co. Front Cover
Pittsburgh Steel Co. —
Portland Cement Asso. 14
Potter, Alexander 72
Proportioneers, Inc. 66

R

Reeves Pulley Company. 75
Reilly Tar & Chemical Corp. 7
Riddick, Thomas M. 72
Roberts Filter Mfg. Co. 78
Royer Foundry & Machine Co. 8
Russell & Axon. 72

S

*Servicised Products Corp. —
*Simplex Valve & Meter Co. 77
Smith & Co., Gordon. 66
South Bend Foundry Co. 79
Sparling, R. W. 75

T

Tar & Chemical Div. of Koppers Co. 13
*Taylor & Co., Inc., W. A. 74

U

*United States Pipe & Foundry Co. Second Cover

V

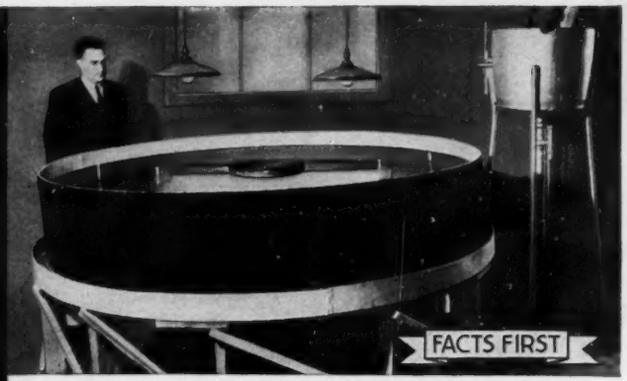
Victor Equipment Company. 3
*Vogt Mfg. Co., Inc. —

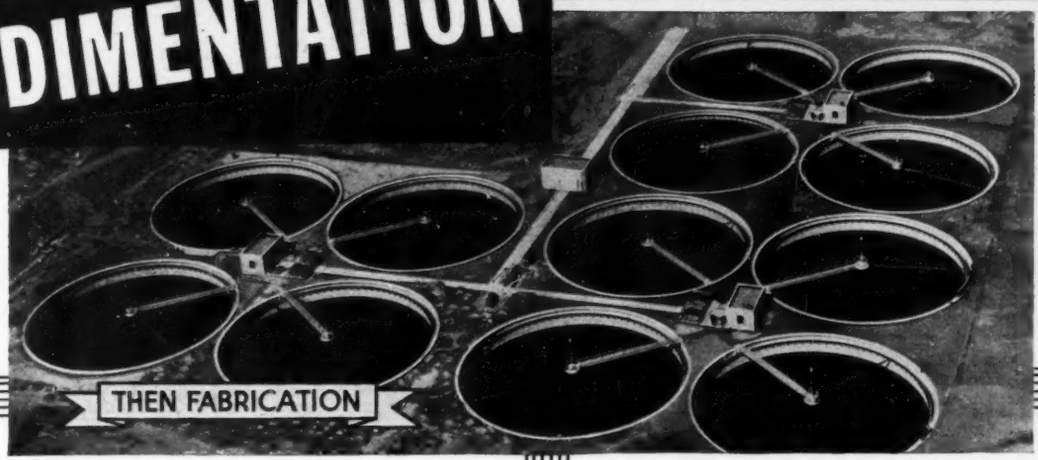
W

*Wallace & Tiernan Co. Back Cover
Water Leak Detector Co. —
Western Gas Div. of Koppers Co. 13
White Tar Co. of New Jersey, Inc. 13
Whitman & Howard. 72
*Wood Co., R. D. 19
Wood Preserving Corp. 13
Worthington Pump & Mach. Corp. —

*Advertisers with * were represented in the May, 1936, Convention and Data Edition with catalog specification copy. Please refer to that issue for additional information on any of their products.

Setting the PACE in SEDIMENTATION





Washington, D. C.

For twenty odd years Dorr Clarifiers have been in a state of continuous evolution and betterment. Step by step, the modern Dorr Clarifier has emerged from the pioneering stage, born of changing conditions, sired by fundamental, sedimentation research.

Today Dorr sedimentation research in the field and in the laboratory is continuous and unremitting. First on a small scale, then on progressively larger ones, are the most promising research findings translated into commercial realization.

The Knowledge, Experience and Background of the Dorr organization are hidden values that neither appear on the invoice nor add to the shipping weight, but are the most enduring elements of every Dorr transaction.

DORRCO

Distinctive Features of The Dorr Clarifier

Method of Feeding
Central feed through an inverted siphon—assuring quiescent, sub-surface distribution along diverging radial lines.

Method of Overflowing
Peripheral collection of overflow across a continuous weir—permitting take-off of clarified effluent at minimum possible velocity.

Sludge Collection
A slowly revolving mechanism, hung from a stationary central column, equipped with self-raising and lowering arms for automatic overload relief.

Scum Removal
A skimming arm, actuated by the raking mechanism, for removing periodically scum and other floating materials.

Service
Inspection after erection and supervision of initial operation, always. Supervision of erection, too, if desired.

THE DORR COMPANY INC.

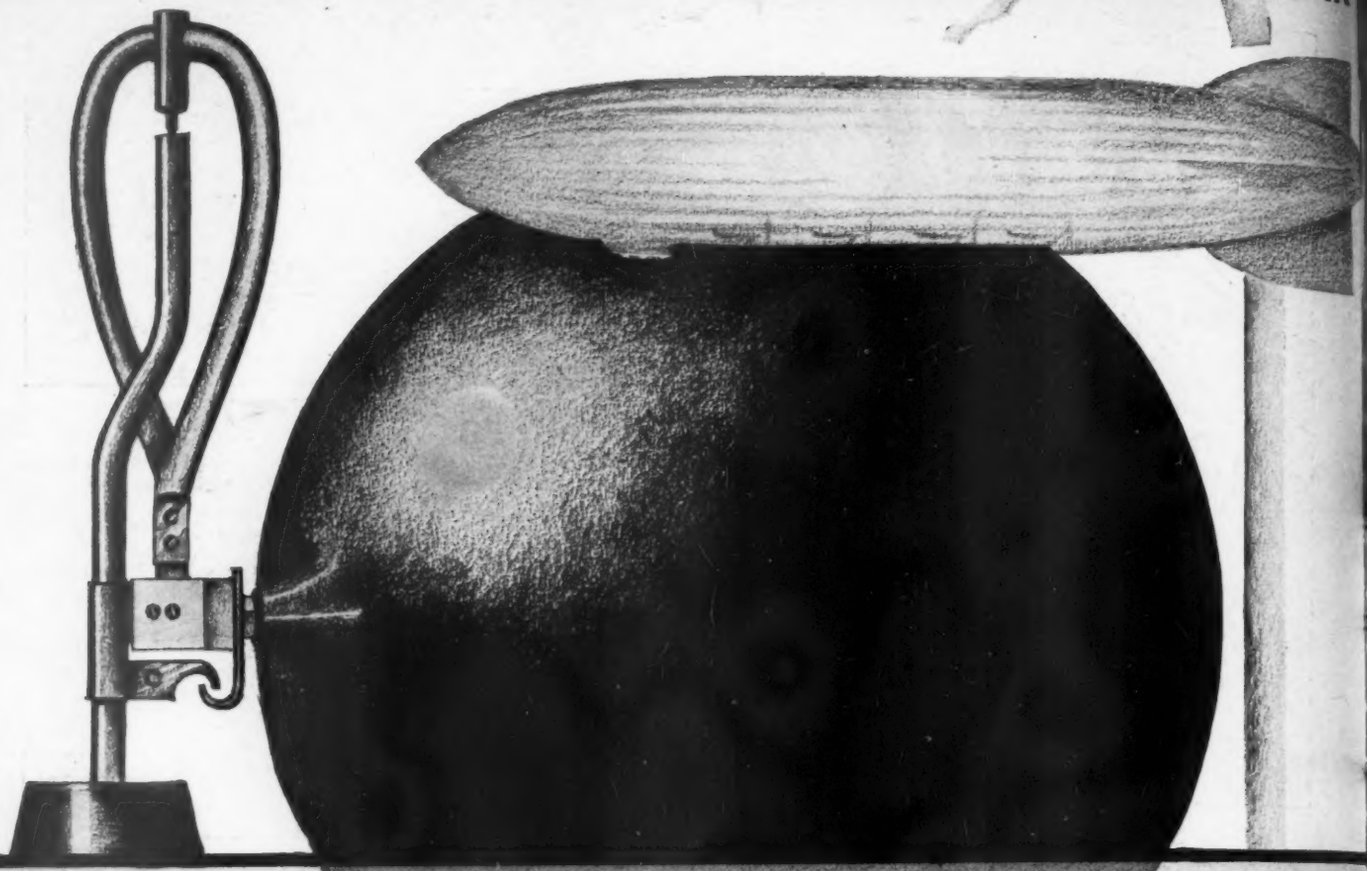
ENGINEERS • 570 Lexington Ave., New York

CHICAGO • TORONTO • DENVER • LOS ANGELES • ATLANTA

DORR TECHNICAL SERVICES AND EQUIPMENT ARE AVAILABLE FROM THE FOLLOWING COMPANIES:

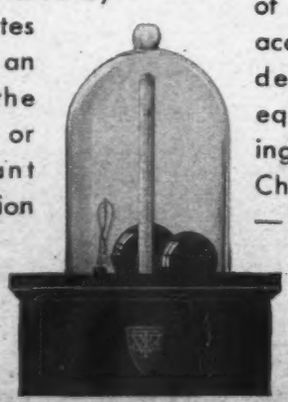
HOLLAND: Dorr-Oliver N. V. The Hague
FRANCE: Soc. Dorr-Oliver, Paris
GERMANY: Dorr Gesellschaft, m. b. H. Berlin
ENGLAND: Dorr-Oliver Company Ltd., London
AUSTRALIA: Crossle & Duffy Pty. Ltd., Melbourne
SOUTH AFRICA: Edward L. Bateman Pty. Ltd., Johannesburg
JAPAN: Andrews & George Co. Inc., Tokio
ARGENTINA: Luis Fiore, Buenos Aires
BRAZIL: Oscar Taves & Co., Rio de Janeiro

REAL VALUE FOR YOUR CHLORINATION DOLLAR



Chlorination requires
FLOATING POWER, TOO

POWER that floats on the water inside a bell jar controls the operation of a W&T Visible Vacuum Chlorinator. No hidden diaphragms, no springs—only a needle valve operated by a floating hard rubber ball regulates the inflow of chlorine maintaining an even, constant pressure whether the equipment is feeding at its maximum or minimum. And not only a constant regulation, but a constant protection against escape of gas should the operating water supply fail. Immediately, the floating ball drops, seating the needle valve, and the gas is cut off until the trouble may be investigated and operation resumed.



Such carefully thought out design, coupled with meticulous attention to every small detail of material selection and manufacturing, accounts for the recognized accuracy, dependability and long life of W&T equipment. When specifying or purchasing equipment for the important job of Chlorination, be sure you call for W&T — for over twenty years the accepted standard of Real Value in the Chlorinator field.

Ask for Technical Publications 38, 157 and 158.

"The Only Safe Water is a Sterilized Water"

WALLACE & TIERNAN CO. INC.

Manufacturers of Chlorine and Ammonia Control Apparatus

NEWARK, N. J. Branches in Principal Cities

CHLORINATORS FOR WATER WORKS • SEWAGE PLANTS • SWIMMING POOLS • INDUSTRIAL PLANTS

SA-71